VILLAGE OF MARVIN
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PLANNING BOARD AND VILLAGE COUNCIL SPECIAL MEETING MINUTES

October 14, 2019 – 7:30 pm
Banks Fellowship Hall, 10012 New Town Road
Joint Meeting - **REVISED**

AGENDA ITEM

TIME STAMP: 0:05
1. Call to Order
Mayor Pollino called the meeting to order at 7:30 p.m.

Council Members Present: Mayor Pollino, Mayor Pro Tem Dispenziere, Councilwoman Vandenberg, and Councilwoman Shkut
Council Members Absent: Councilman Epps

Staff Present:
Ms. Christina Amos, Administrator
Ms. Barbie Blackwell, Clerk
Mr. Rohit Ammanamanchi, Senior Planner/Zoning Administrator
Mr. Chaplin Spencer, Attorney

Planning Board:
Chairman Jones called the meeting to order at 7:35 p.m.

Planning Board Members Present: John Jones, Mark Petersen, Michael Lavelle, Kelly Cates, Tom Traub, and Chris Smith
Planning Board Members Absent: No members were absent.

TIME STAMP: 1:17
2. Adoption of the Agenda

MOTION-1: Councilwoman Shkut made motion to adopt the agenda as presented for Council.
VOTE-1: The motion passed with a vote of 3-0.

MOTION-2: Mr. Petersen made motion to adopt the agenda as presented.
VOTE-2: The motion passed with unanimous vote of Planning Board.

TIME STAMP: 2:22
3. Public Comments
Mayor Pollino reminded visitors that public comments were limited to 3-minutes and asked them to state their name and address. He introduced Mr. Chaplin Spencer, Village Attorney and the representatives from Land Design.

Mr. Chaplin Spencer, Village Attorney, explained the steps in the rezoning process as an informal meeting to gather more information on the potential rezoning application #19-12296. He stated that no action of Council or Planning Board would be taking place.

Mr. Mark Kimme, LandDesign, Inc., the landscape architect for the project, he introduced the following representatives working on the project: Ralph Klout, Engineer with LandDesign, Laura Reid, Traffic Consultant with Kimley-Horn and Mr. Ashok Patel, Owner/Developer. Mr. Kimme explained the developer's intent for the site.

General Project Description:
The Owner intends to develop 50,000 square feet of retail and office space on 9.42 Acres of land at the corner of Providence Road South and Bonds Grove Church Road. There are two-large 10,000 square feet buildings are proposed to be two-stories in height and may contain a mixture of retail and office space. Two additional outparcels of 5,000 square feet each are proposed at the southeastern corner

of the site. The buildings have been sited adjacent to the perimeter rights of way to maximize the distance between the proposed buildings and adjacent residential zoning and provide adequate visibility to future business from Providence Road South. Access to the site is proposed in two locations: (1) is proposed at the northeastern corner of the site and will be a right in/right out access only from Providence Road South; (2) is proposed as a full movement intersection at the southwestern corner of the site along Bonds Grove Church Road. They propose a 100-foot buffer along the Courtyards of Marvin development and a 70-foot landscape buffer along the back edge of the property including supplemental vegetation to increase the buffer for the adjacent residential and proposed development. Parking would be 1 space for every 200 square feet of proposed retail office which totals approximately 250 spaces. They showed exiting drainage in the middle of the property and they proposed two dry detention ponds (sand filter) to collect the runoff water, treat it and release it at a rate equal to or less currently on the site.

Residents shared their comments regarding the proposed rezoning project:

Diane DeMacio, 2053 Belle Grove Drive, Marvin, NC, provided her written statement to the Clerk.

Michelle Shivers, 2038 Belle Grove Drive, Marvin, NC, she expressed that she is not opposed of the rezoning but she was opposed of the uncertainty of development deadlines. She also expressed her concerns regarding traffic congestion and the impacts it would have to residents in Providence Road West area.

Stacy Koenky, 8300 Cornerbrook Place, Marvin, NC, she expressed her concerns regarding the developments appearance and what it would attract, traffic congestion and the impacts it would have for the area. She shared pictures of nearby restaurants and their outside appearance.

Wendy Magee-Hagen, 1401 Morning Mist Court, Marvin, NC, she expressed her concerns regarding the proposed rezoning, traffic congestion and the impacts it would have to residents in the area and the drainage on the proposed site.

Alex Elmes, 1409 Moring Mist Court, Marvin, NC, he expressed his concerns regarding the drainage on the site and the impacts it has on him and his neighbors, the traffic congestion and that nothing should happen until a traffic light is installed. The community does not support the development.

Doug Englebauch, 1226 Restoration Drive, Marvin, NC, he expressed his concerns regarding home values, noise, lighting, foot traffic, drainage runoff and who is responsible for any damage to the Courtyards of Marvin's ponds, and what is the Village of Marvin's benefit for the development.

Bob Marcolese, 9904 Heritage Oak Lane, Marvin, NC, candidate for the Village of Marvin, he stated his attendance was to listen, he expressed that he was aware of national preservation and experience with opposition of retail centers.

Kimley-Horn presented the Traffic Impact Analysis for the site. *(See the attached TIA is hereby incorporated as reference into these minutes.)*

TIME STAMP: 50:09

4. Discuss Application #19-12296 Rezoning to Commercial Corridor-Conditional District

The Council and Planning Board discussed the rezoning application at length.

The Council recommended that future applicants exercise the option to have an informal meeting with Council.

ADJOURNMENT

TIME STAMP: 2:32:24

MOTION-1: Mr. Petersen adjourned the Planning Board Joint Meeting with Council at 10:07 p.m.

VOTE-1: The motion passed with a unanimous vote.

MOTION-2: Mayor Pollino adjourned the Council Joint Meeting with Planning Board at 10:07 p.m.

VOTE-2: The motion passed with a vote of 3-0.

Adopted: 12/17/2019

VILLAGE OF MARVIN SEAL N.C.

John Jones, Chairman

Barbara R. Blackwell, NCCMC
Clerk, Village of Marvin

Traffic Impact Analysis for Providence Road Commercial Marvin, North Carolina

Prepared for:

Shree Umiya Associates, LLC
Purchase, New York

Prepared by:

Kimley-Horn and Associates, Inc.
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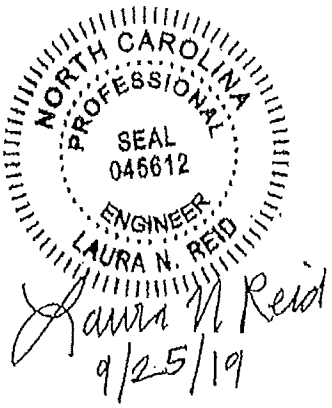
Charlotte, North Carolina 28202
(704) 333-5131



September 2019
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Providence Road (NC 16) and Access A (RIRO)

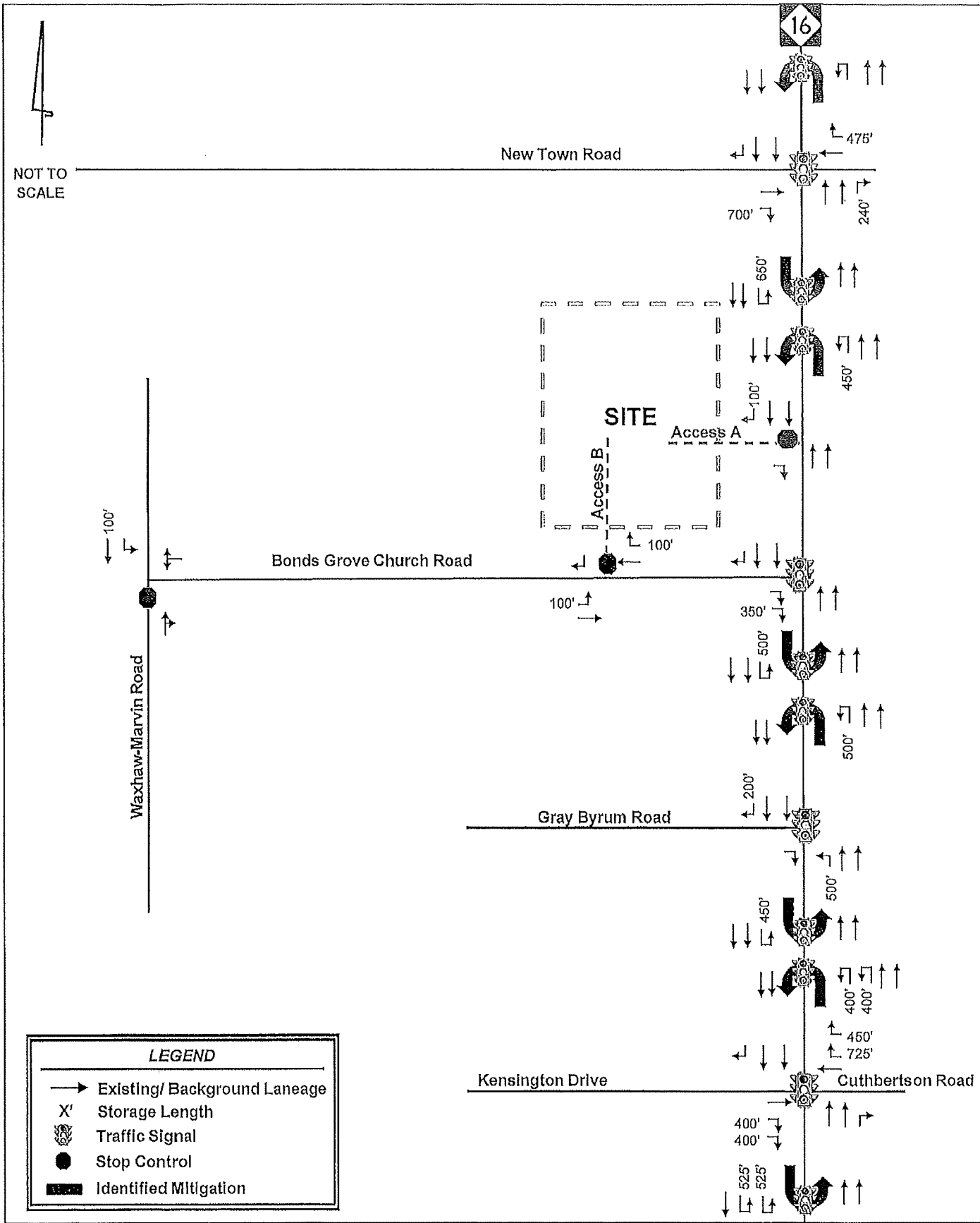
- Southbound right-turn lane along Providence Road (NC 16) with 100 feet of storage
- Single egress lane and single egress lane along Access A

Bonds Grove Church Road and Access B (Left-Over)

- Eastbound left-turn lane along Bonds Grove Church Road with 100 feet of storage
- Westbound right-turn lane along Bonds Grove Church Road with 100 feet of storage
- Single egress lane and single ingress lane along Access B

No additional improvements were identified to mitigate the impact of the proposed development on the adjacent street network during the 2040 conditions.

The mitigation improvements identified within the study area are shown for 2024 and 2040 conditions in Figure 1.1. The improvements shown on this figure are subject to approval by NCDOT and the Village of Marvin. All additions and attachments to the State and Village roadway system shall be properly permitted, designed, and constructed in conformance to standards maintained by the agencies.



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Identified Mitigation Improvements	Figure 1.1

2.0 Introduction

The proposed Providence Road Commercial development is located in the Village of Marvin, North Carolina, where two (2) single-family homes currently sits within the northwest quadrant of Providence Road (NC 16) at Bonds Grove Church Road. Based on the current site plan, the proposed development is envisioned to include +/- 50,000 square feet (SF) of shopping center space. Per the TIA scoping process, the following land uses and intensities were used for the purposes of this TIA:

- 41,600 square feet (SF) of Shopping Center
- 4,500 SF High-Turnover Sit-Down Restaurant
- 3,500 SF Drive-In Bank

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2024. Based upon the provided site plan, the proposed development will be accessed via the following access points:

- Access A – A right-in/right-out (RIRO) driveway connection to Providence Road (NC 16), approximately 450 feet north of Bonds Grove Church Road; north of the proposed location of the future northbound U-turn bulb associated with the current superstreet design planned as part of State Transportation Improvement Program (STIP) Project U-5769
- Access B - A left-over driveway connection to Bonds Grove Church, located approximately 400 west of Providence Road (NC 16)

Based upon the trip generation potential, the proposed development meets the North Carolina Department of Transportation (NCDOT) thresholds for requiring a TIA. NCDOT's TIA Scoping Checklist was developed and was reviewed and agreed upon by the Village of Marvin and NCDOT. The approved TIA Scoping Checklist is included in the **Appendix**.

Kimley-Horn was retained to determine the potential transportation impacts of this development (in accordance with the traffic study guidelines in the *NCDOT Policy on Street and Driveway Access to North Carolina Highways*) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, capacity analyses and identified transportation improvements required to mitigate anticipated traffic demands produced by the subject development.

3.0 Existing Traffic Conditions

Existing traffic conditions were coordinated with Village of Marvin and NCDOT staffs and collected through field observations and turning-movement counts to establish the existing conditions baseline analysis.

3.1 STUDY AREA

Based on coordination with the Village, NCDOT and the applicant, the study area for this TIA includes the following existing intersections:

1. Providence Road (NC 16) and New Town Road
2. Providence Road (NC 16) and Bonds Grove Church Road
3. Providence Road (NC 16) and Gray Byrum Road
4. Providence Road (NC 16) and Kensington Drive/Cuthbertson Road
5. Bonds Grove Church Road and Waxhaw-Marvin Road

Figure 3.1 shows the study area intersections and the site location, **Figure 3.2** shows the proposed site plan for the development and **Figure 3.3** shows the existing roadway geometry at the existing study intersections. A full-sized site plan to scale is provided in the **Appendix**. It should be noted that the current site plan shows general retail land uses, but for the purposes of the TIA, trip generation was performed for this site as outlined in **Section 5.2**.

The primary roadways in the vicinity of the site are Providence Road (NC 16), New Town Road, Bonds Grove Church Road, Gray Byrum Road, Kensington Drive, Cuthbertson Road, and Waxhaw-Marvin Road. The information below describes existing conditions for portions of these roadways within the vicinity of the site.

Providence Road (NC 16) is predominantly a two-lane, undivided highway throughout the study area, but develops into a three-lane, divided facility from Sunset Hill Road to just south of Kensington Drive/Cuthbertson Road. Two northbound lanes and one southbound lane exist through this section with the eastern curb line set with a curb and gutter, planting strip, sidewalk and appropriate offset from the retail that exists east of Providence Road (NC 16). Providence Road (NC 16) tapers back to a two-lane, undivided section north of Sunset Hill Road. This state highway is classified as a minor arterial by NCDOT's functional classification system. Providence Road (NC 16) has a speed limit of 45 mph throughout the study area and an average daily traffic (ADT) volume of 16,500 vehicles per day (vpd) north of Kensington Drive/Cuthbertson Road and an ADT of 19,500 vpd south of New Town Road based upon 2018 NCDOT ADT maps.

New Town Road is a two-lane, undivided major collector with a posted speed limit of 45 mph in the vicinity of the proposed development. New Town Road has an ADT volume of 9,100 vpd west of Providence Road (NC 16) and 7,500 vpd east of Providence Road (NC 16) based upon 2018 NCDOT ADT maps.

Bonds Grove Church Road is a two-lane, undivided local roadway with a posted speed limit of 45 mph in the vicinity of the proposed development. Bonds Grove Church Road has an ADT volume of 3,500 vpd west of Providence Road (NC 16) based upon 2018 NCDOT ADT maps.

Gray Byrum Road is a two-lane, undivided minor thoroughfare with a posted speed limit of 45 mph in the vicinity of the proposed development. Gray Byrum Road has a 2018 NCDOT ADT of 3,900 vpd west of Providence Road (NC 16).

Kensington Drive is a two-lane, undivided local roadway with on-street parking and a posted speed limit of 25 mph in the vicinity of the proposed development. There is no posted NCDOT ADT for this roadway.

Cuthbertson Road is a two-lane, undivided minor thoroughfare with a posted speed limit of 45 mph in the vicinity of the proposed development. Cuthbertson Road has a 2016 NCDOT ADT of 11,000 vpd east of Providence Road (NC 16).

Waxhaw-Marvin Road is a two-lane, undivided minor collector with a posted speed limit of 45 mph in the vicinity of the proposed development. Waxhaw-Marvin Road has a 2018 NCDOT ADT of 7,300 vpd southeast of Bonds Grove Church Road.

3.2 EXISTING INTERSECTION VOLUME DEVELOPMENT

AM (7:00-9:00) and PM (4:00-6:00) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts were performed by Quality Counts, LLC on Wednesday, May 29, 2019, at the following intersections:

1. Providence Road (NC 16) and New Town Road
2. Providence Road (NC 16) and Bonds Grove Church Road
3. Providence Road (NC 16) and Gray Byrum Road
4. Bonds Grove Church Road and Waxhaw-Marvin Road

In addition, AM (6:30-8:30) and PM (4:30-7:00) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts were performed by National Data & Surveying Services on Wednesday, March 27, 2019, at the following intersection:

1. Providence Road (NC 16) and Kensington Drive/Cuthbertson Road

This count was obtained from the *South Creek Commercial Traffic Impact Analysis* (Kimley-Horn, June 2019).

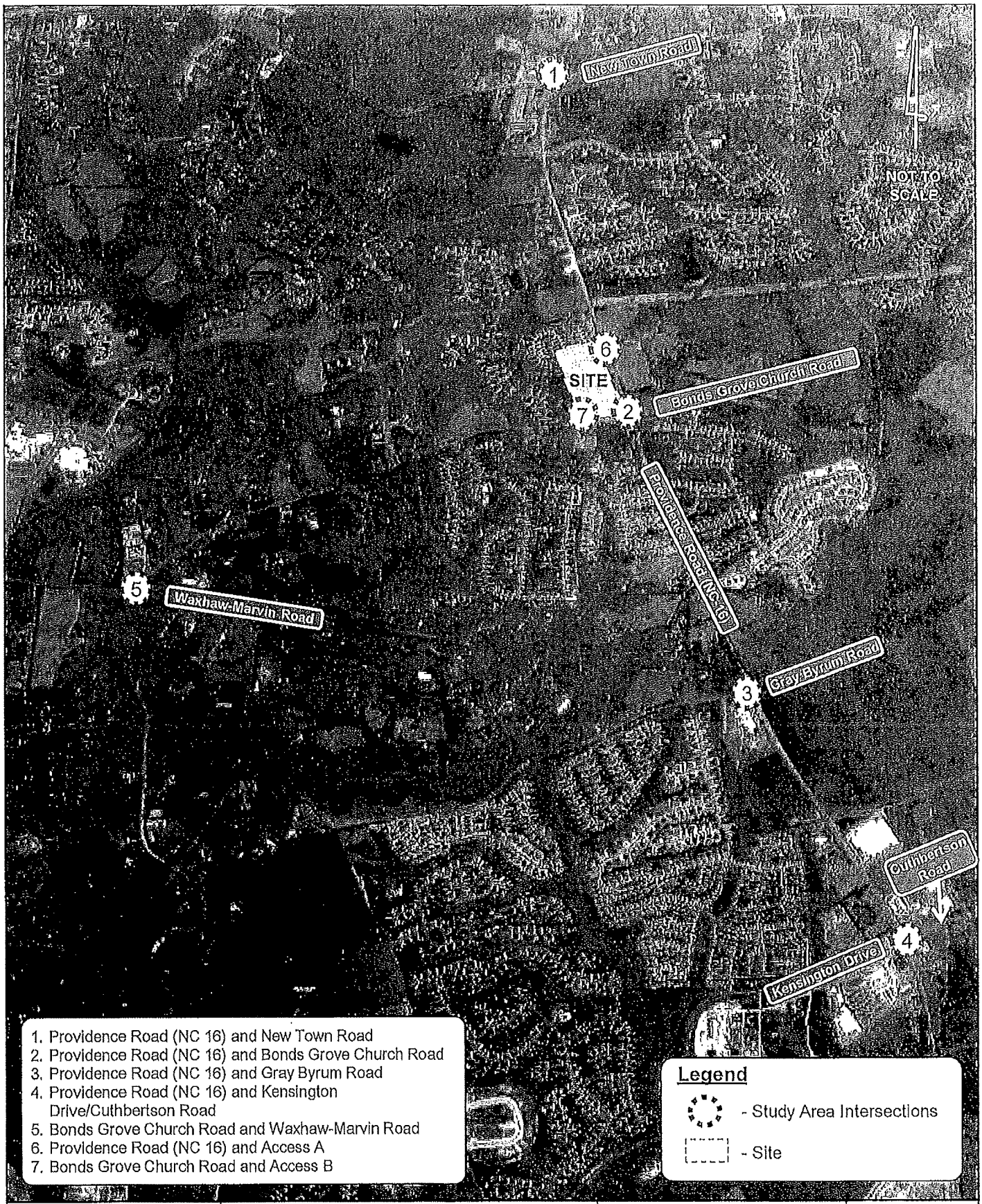
The specific AM peak hour differed between 7:00-8:00AM, 7:15-8:15AM and 7:30-8:30AM and the specific PM peak hour differed between 4:00-5:00PM, 5:00-6:00PM and 5:15-6:15PM. The specific peak hour of each individual intersection was used as the baseline data to represent the highest collected traffic volumes within the specified count timeframes. The peak hours for each of the intersections are shown in **Table 3.1.**

Table 3.1 – AM & PM Intersection Peak Hours

Intersection	AM Peak Hour	PM Peak Hour
1. Providence Road (NC 16) and New Town Road	7:30 AM - 8:30 AM	5:00 PM - 6:00 PM
2. Providence Road (NC 16) and Bonds Grove Church Road	7:00 AM - 8:00 AM	5:00 PM - 6:00 PM
3. Providence Road (NC 16) and Gray Byrum Road	7:15 AM - 8:15 AM	4:00 PM - 5:00 PM
4. Providence Road (NC 16) and Kensington Drive	7:30 AM - 8:30 AM	5:15 PM - 6:15 PM
5. Bonds Grove Church Road and Waxhaw-Marvin Road	7:00 AM - 8:00 AM	5:00 PM - 6:00 PM

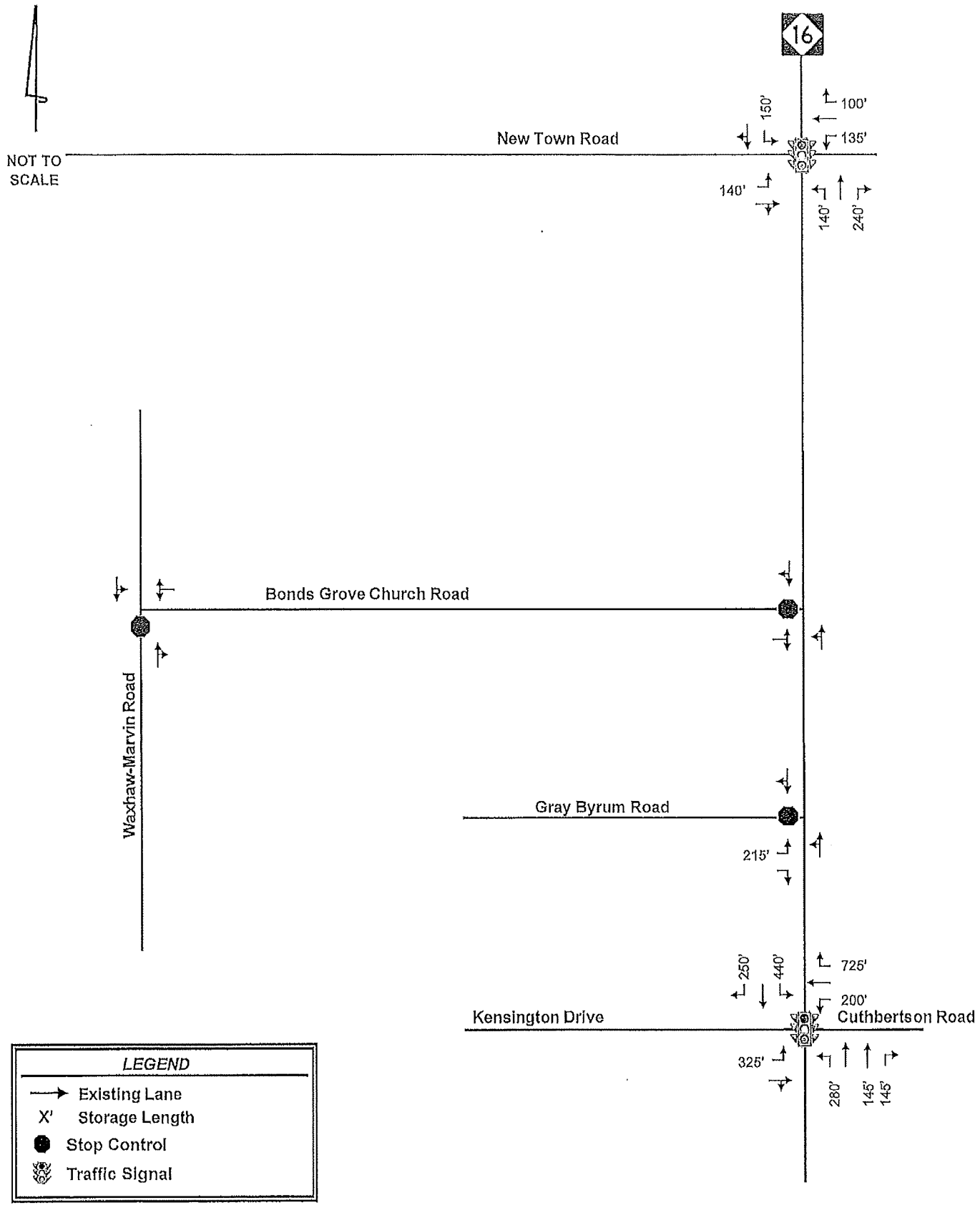
No volume balancing was performed throughout the study area due to the presence of commercial and residential driveways between each of the study intersections. Peak-hour intersection turning-movement count data is provided in the **Appendix.**

Figure 3.4 shows the 2019 existing AM and PM peak-hour traffic volumes.

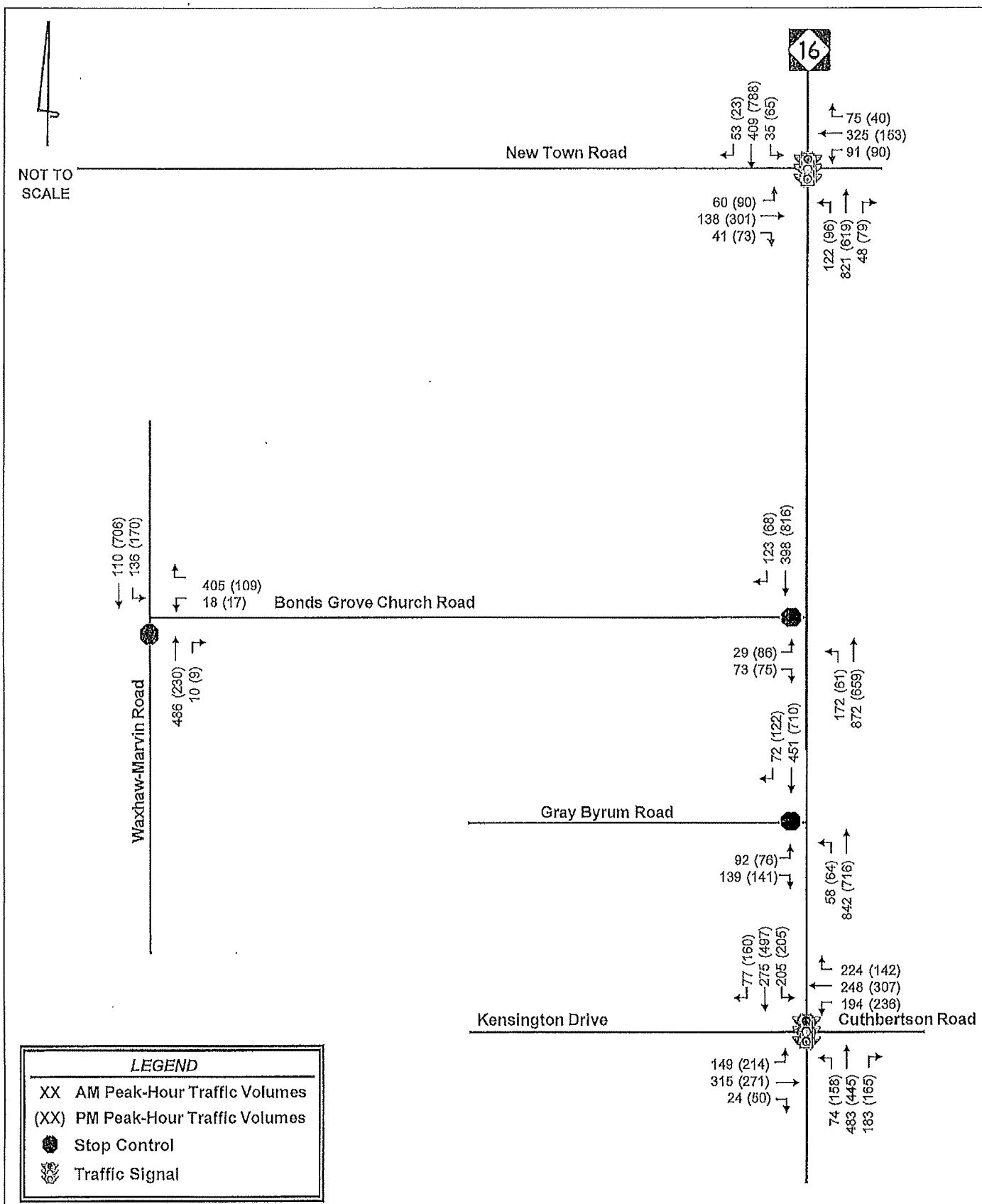


Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Study Area / Site Location	Figure 3.1

Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Proposed Site Plan	Figure 3.2



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Existing Roadway Laneage	Figure 3.3



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2019 Existing Traffic Volumes	Figure 3.4

4.0 Background Traffic Volume Development

Projected background (non-project) traffic is defined as the expected growth or change in traffic volumes on the surrounding roadway network between the year the existing counts were collected (2019) and the expected build-out year (2024) absent the construction and opening of the proposed project. This includes both non-specific general growth based on historical increase in local traffic volumes (historical background growth), along with specific growth and/or change in traffic volumes caused by approved off-site developments that are not yet fully-constructed, and/or planned transportation projects specifically identified within the vicinity of the proposed development.

4.1 HISTORICAL BACKGROUND GROWTH TRAFFIC

Historical background growth is the increase in existing traffic volumes due to usage increases and non-specific growth throughout the area, and accounts for growth that is independent of specific off-site developments or planned transportation projects. Historical background growth traffic is calculated using an annual growth rate, which is applied to the existing traffic volumes up to the future horizon years. As shown in the approved NCDOT Scoping Checklist, an annual growth rate of two percent (2%) was applied to the 2019 existing peak-hour traffic volumes to calculate base 2024 background traffic volumes. This growth rate was determined through coordination with NCDOT and Village of Marvin staffs.

The 2040 background traffic volumes were obtained from the forecast traffic volumes prepared by Patriot Transportation Engineering, PLLC as part of the NCDOT TIP Project U-5769.

4.2 APPROVED DEVELOPMENTS

Based upon input from the Village of Marvin and NCDOT staffs, five (5) approved developments that are expected to impact traffic volumes within the study area were included in the background traffic volumes for this TIA. These developments, land uses and intensities, and approximate build-out percentages are outlined in **Table 4.1**. It should be noted that while some of these developments do have committed improvements at study area intersections, future year conditions include U-5769 along the Providence Road (NC 16) corridor. These improvements, as outlined in **Section 4.3**, were considered the ultimate laneage along this corridor.

Table 4.1 – Approved Developments

Development	Land Use/Intensity	% Build-out	TIA Included?
Millbridge	Single Family Res – 1,720 DU Elemen School – 800 students	55%	Yes
Cureton	Retail – 436,034 SF Office – 69,000 SF Single Family Res – 905 DU	80%	Yes
Marvin Gardens	Supermarket – 50,323 SF Retail – 28,000 SF High-Turnover Sit-Down – 5,000SF Coffee Shop w/ DT – 2,000 SF Senior Detached – 35 DU Convenience Market w/ Gas – 8 VFP Bank – 3 Drive-In Lanes	0%	Yes
Prescot Village (Phase 1)	Gas Station/C-Store – 4,123 SF Office – 17,500 SF Gen Retail – 8,260 SF Athletic Club – 7,808 SF	0%	Yes
Carrington Square	General Office – 9,201 SF Grocery Store – 17,840 SF Fast Food w/ DT – 3,607 SF Daycare – 200 Students	0%	Yes

Volumes for the Millbridge (at 55% build out), Cureton, Prescot Village (Phase 1), and Carrington Square developments were obtained from the *South Creek Commercial Traffic Impact Analysis* (Kimley-Horn, June 2019), where the four were included as approved developments as part of that TIA. Volumes for the Marvin Gardens development were obtained from the *Marvin Gardens Traffic Impact Analysis* (Kimley-Horn, June 2015). Site traffic volume figures from the approved TIAs are included in the **Appendix**.

Figures 4.1 and **4.2** show the specific AM and PM peak-hour approved development trips, respectively.

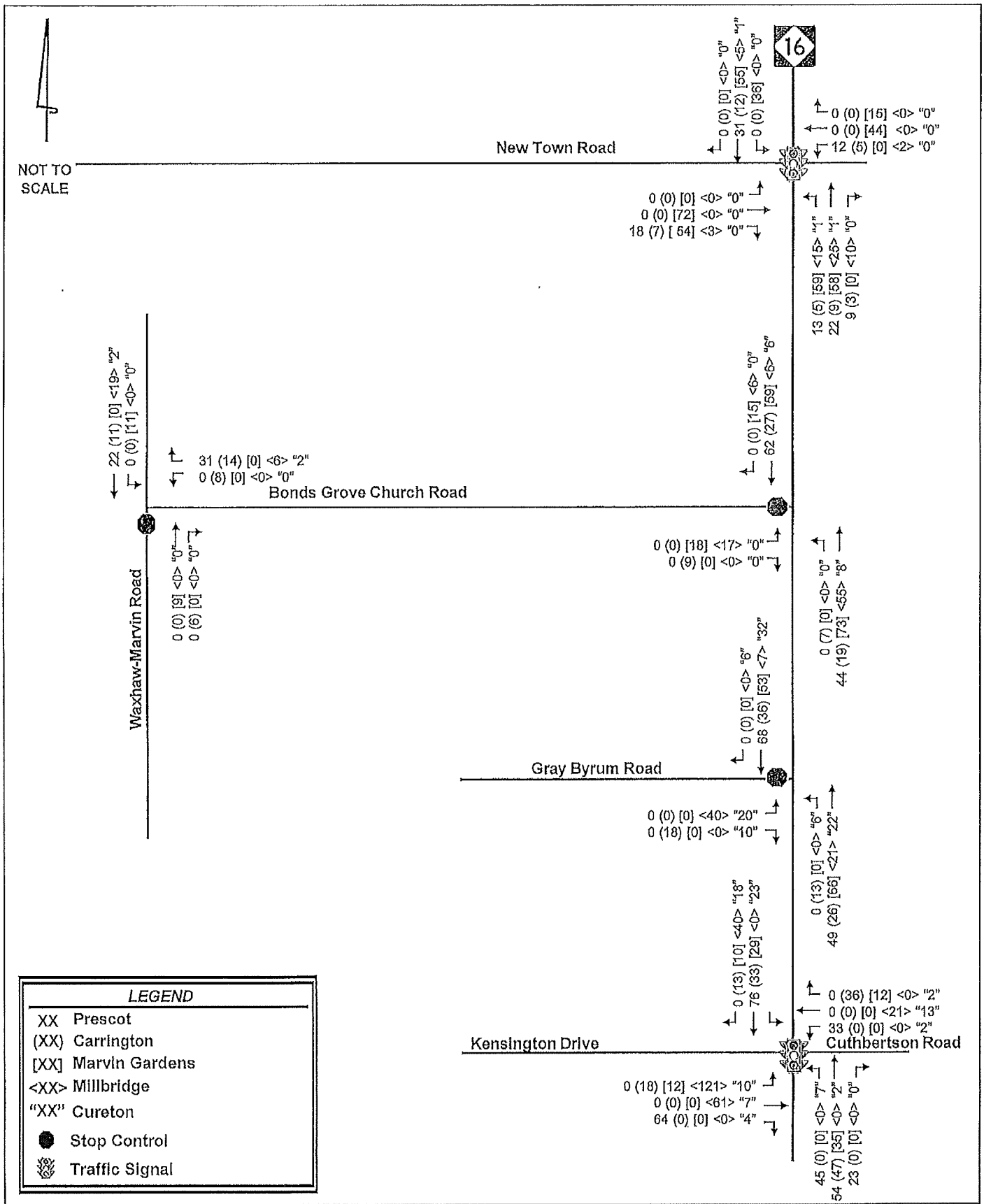
4.3 PLANNED TRANSPORTATION PROJECTS

Based upon review of the adopted transportation plans for the area, one future transportation project is currently funded within the study area. NCDOT TIP Project U-5769, funded and currently being designed to widen Providence Road (NC 16) from Rea Road Extension to Waxhaw Parkway, is expected to have significant impacts to the study area. Based upon coordination with NCDOT, this TIP project intends to improve the study area intersections along Providence Road (NC 16) at New Town Road, Bonds Grove Church Road, Gray Byrum Road, and Kensington Drive/Cuthbertson Road by converting the existing standard full-movement configurations to a reduced conflict intersection (RCI) configuration, where left turns are not allowed. Instead, all left-turn movements will be redirected to U-turn bulbs planned to be constructed along Providence Road (NC 16) north and south of the study area intersections. The one exception to this is at the intersection of Providence Road (NC 16) & Gray Byrum Road where a northbound left-turn movement from Providence Road (NC 16) to Gray Byrum Road is allowed.

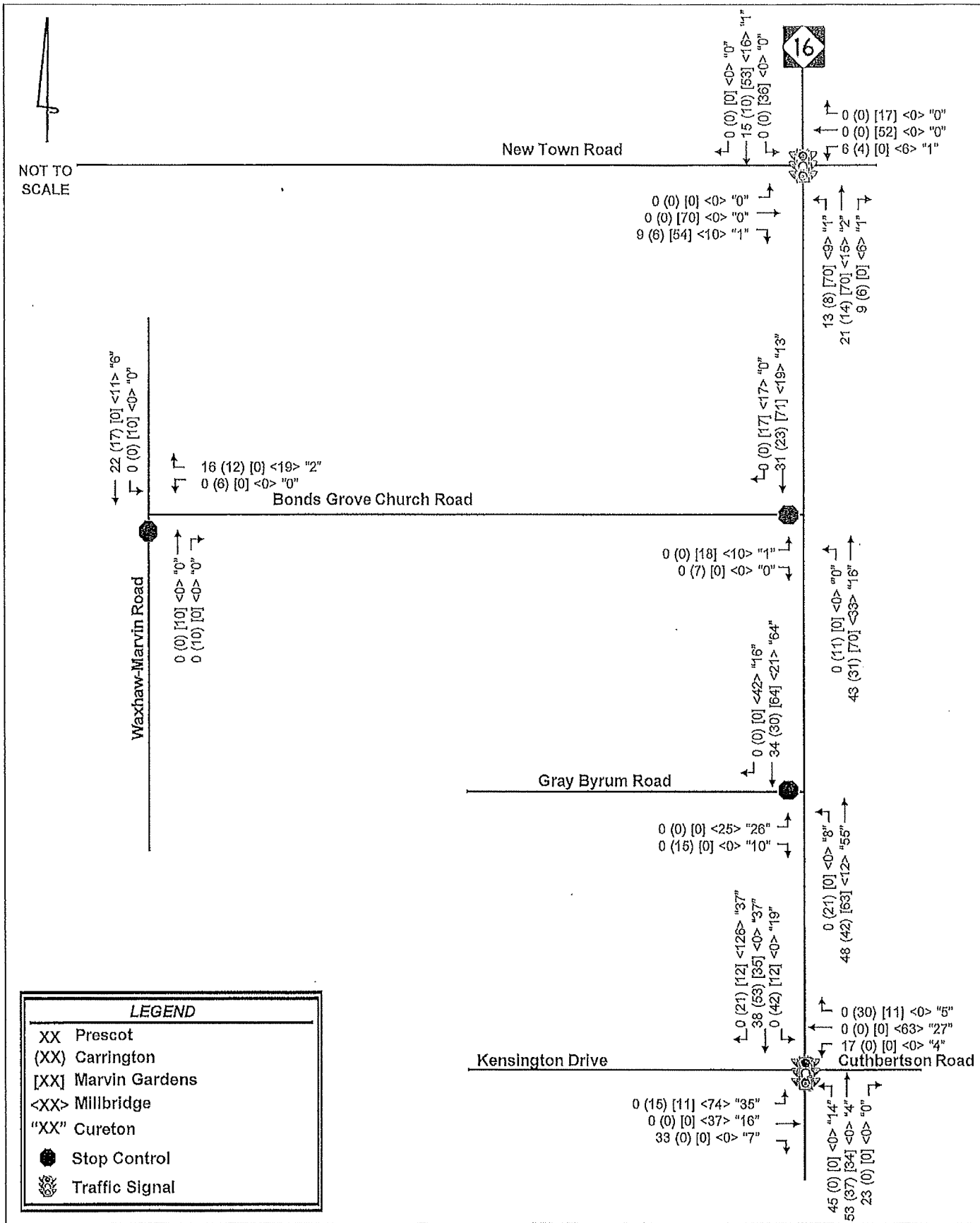
Once constructed, traffic patterns within the subject study area will be altered. Based upon the current NCDOT STIP as of September 2019, this project is scheduled to begin construction in FY 2024; therefore, it was included in 2024 analysis scenarios. A 2040 design year analysis was also performed at the direction of NCDOT. Separate mitigation improvements have been identified, if necessary, at the study intersections under both scenarios with TIP Project U-5769 improvements

in place. Final intersection configurations under TIP Project U-5769 may differ from the improvements outlined in this TIA. The latest concept within the study area provided by NCDOT is included in the **Appendix**.

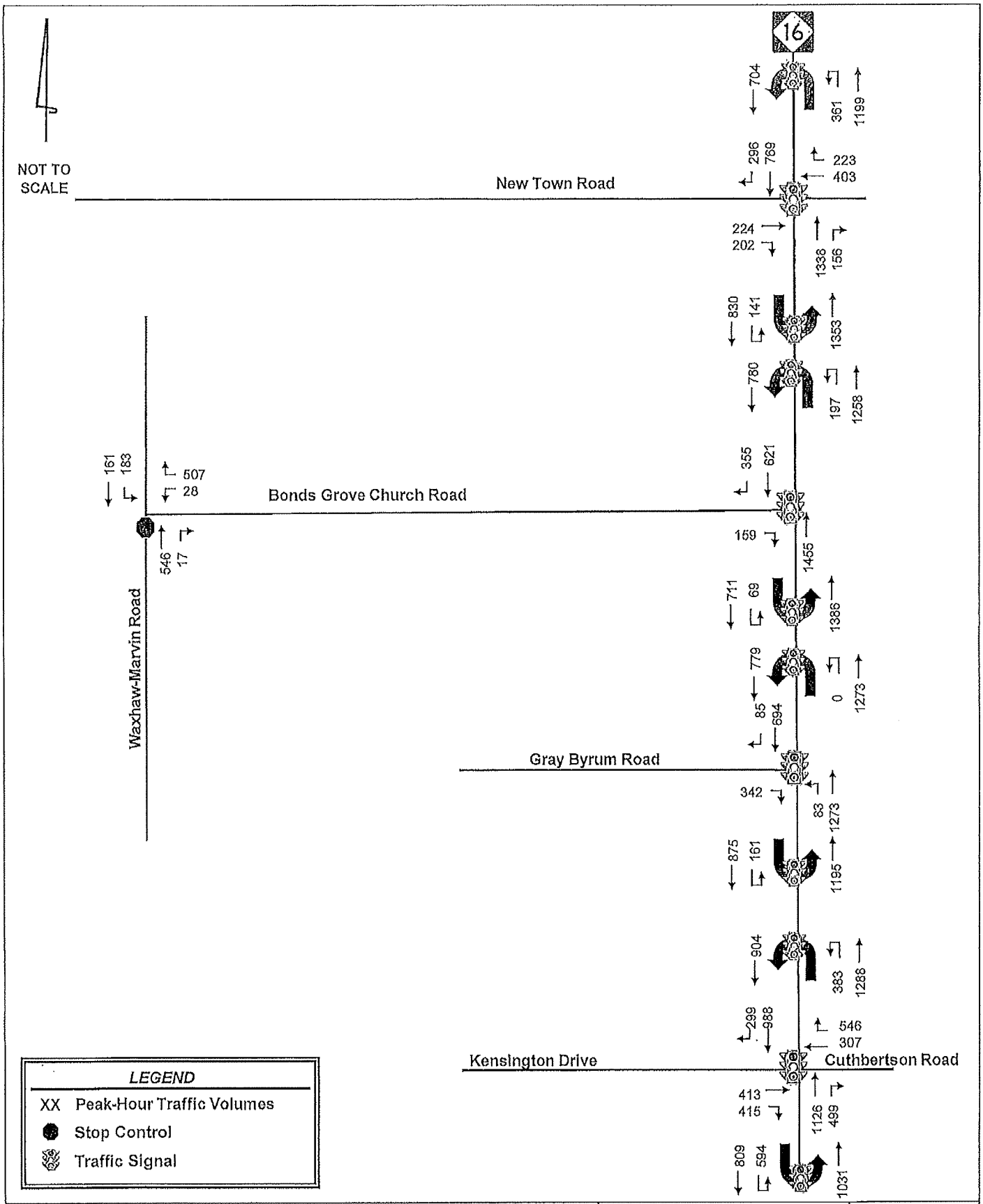
Figures 4.3 and **4.4** show the projected 2024 background AM and PM peak-hour traffic volumes, respectively, that include the historical growth traffic and approved development trips and redistributed volumes due to TIP Project U-5769. **Figures 4.5** and **4.6** show the projected 2040 AM and PM peak-hour background traffic volumes, respectively, that include the projected forecast turning movement counts.



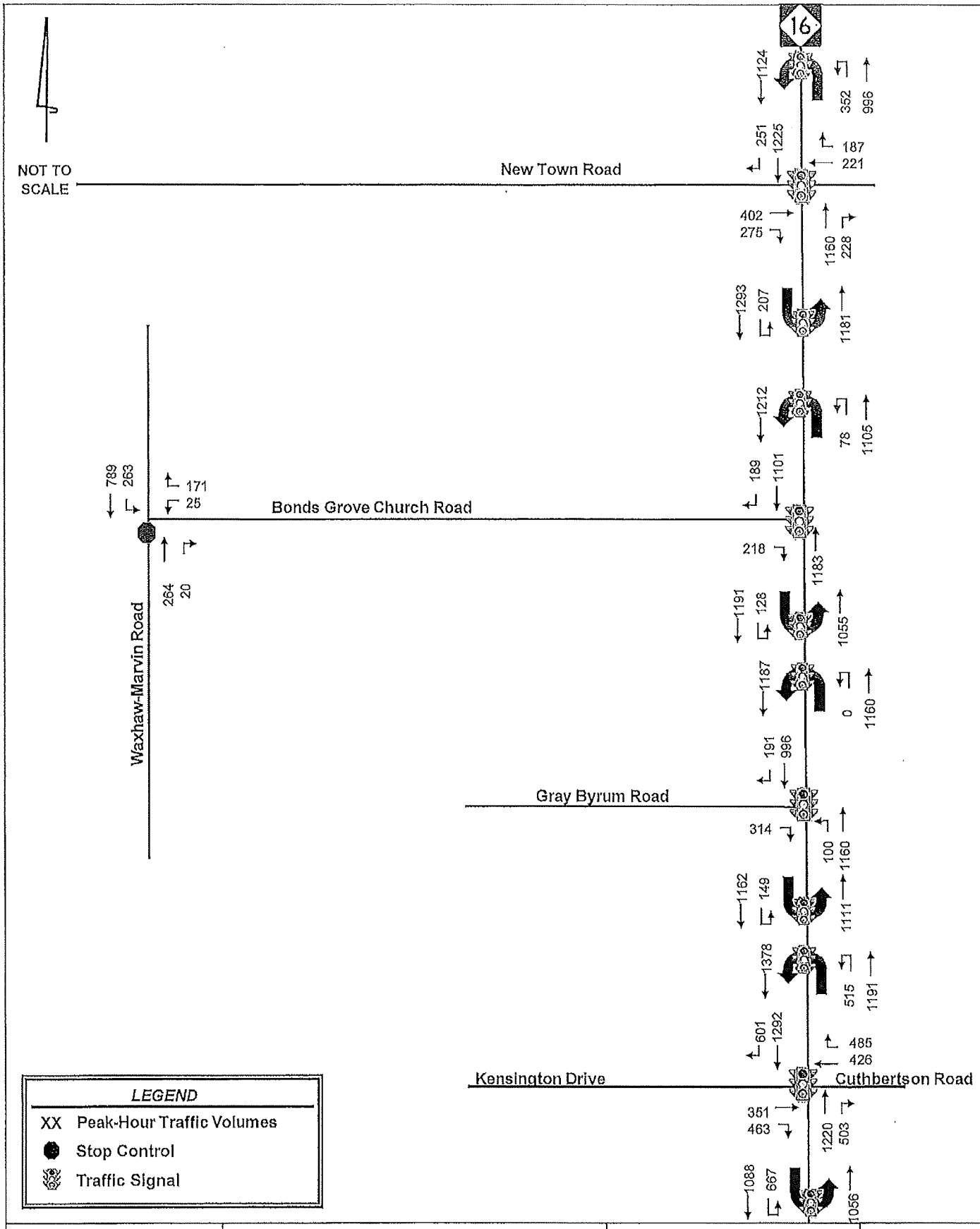
Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Approved Development Site Trips AM Peak Hour	Figure 4.1



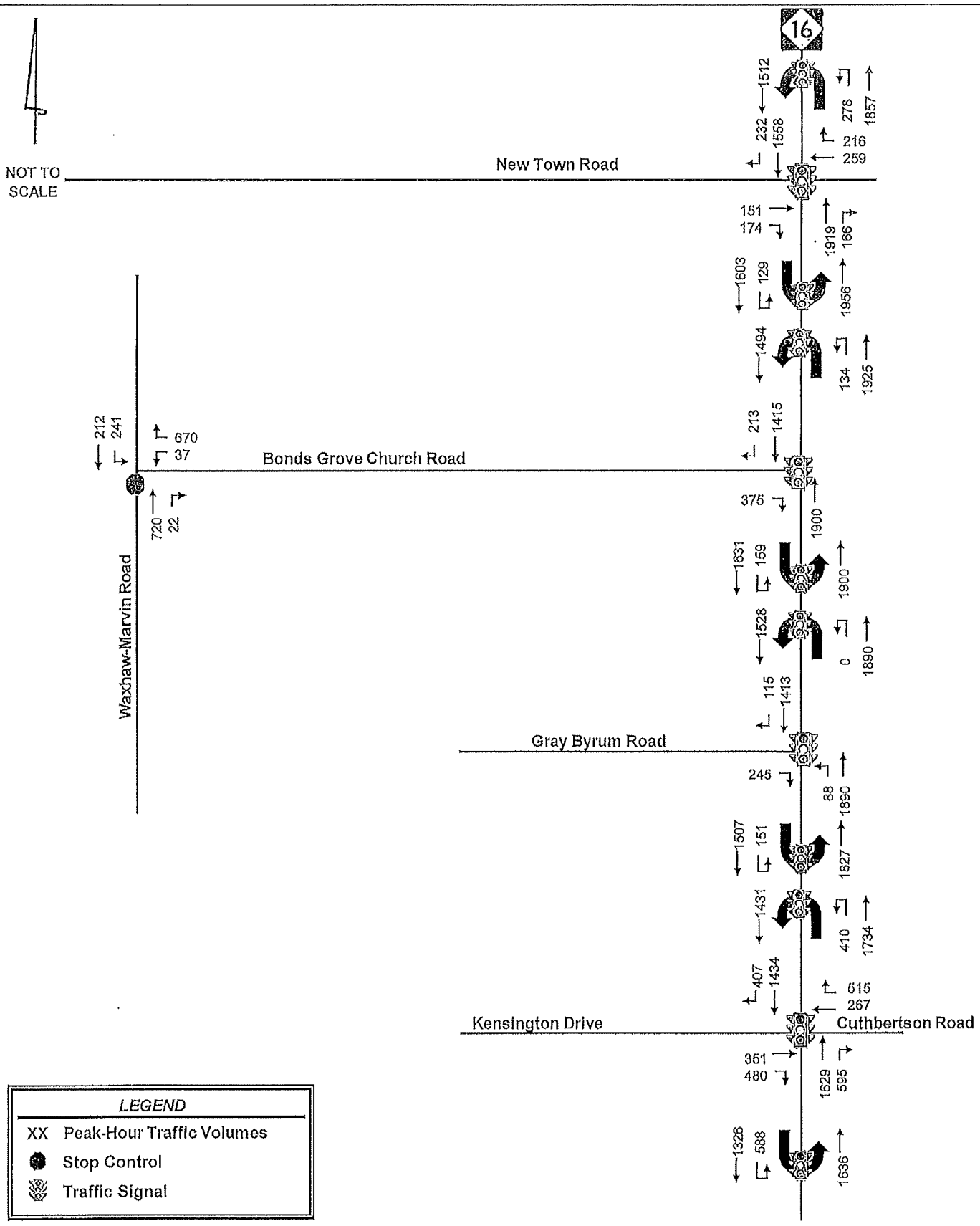
Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Approved Development Site Trips PM Peak Hour	Figure 4.2



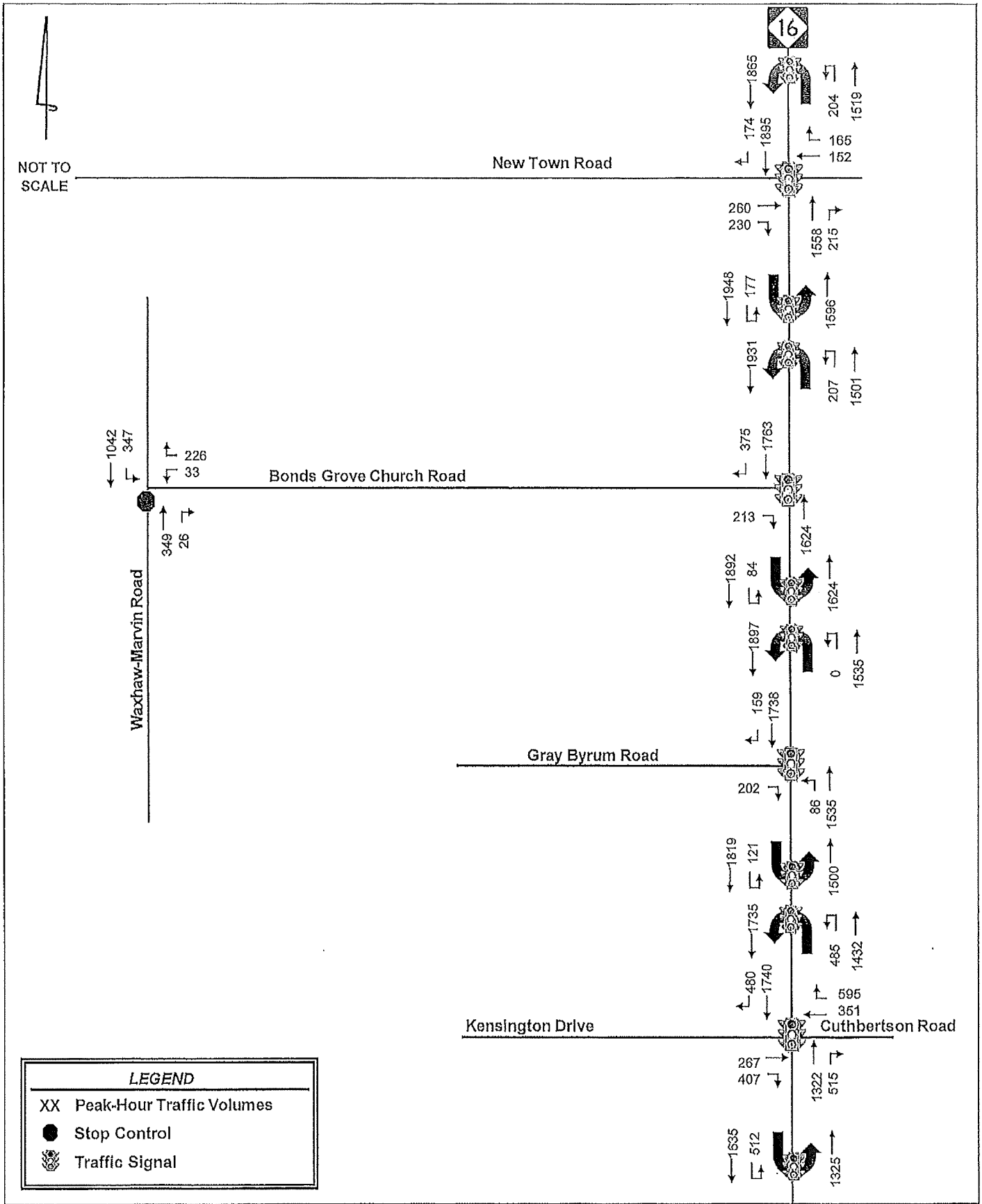
Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2024 Background Traffic Volumes AM Peak-Hour	Figure 4.3



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2024 Background Traffic Volumes PM Peak-Hour	Figure 4.4



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2040 Background Traffic Volumes AM Peak-Hour	Figure 4.5



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2040 Background Traffic Volumes PM Peak-Hour	Figure 4.6

5.0 Site Traffic Volume Development

Site traffic developed for this TIA is defined as the site-generated vehicular trips expected to be added to the study area by the construction of the proposed development, and the distribution and assignment of that traffic throughout the surrounding network.

5.1 SITE ACCESS

Based on the site plan provided by the applicant, the proposed development will be accessed via the following access points:

- Access A – A right-in/right-out (RIRO) driveway connection to Providence Road (NC 16), approximately 450 feet north of Bonds Grove Church Road; north of the proposed location of the future northbound U-turn bulb associated with the current superstreet design planned as part of State Transportation Improvement Program (STIP) Project U-5769
- Access B - A left-over driveway connection to Bonds Grove Church, located approximately 400 west of Providence Road (NC 16)

5.2 TRAFFIC GENERATION

The traffic generation potential of the proposed development was determined using the trip generation rates published in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition, 2017) for all land uses.

Internally captured trips are trips that begin and end within the project site and do not access the external roadway network. Examples of likely internal capture trips include customers visiting the shopping center who may also eat at the restaurant. National Cooperative Highway Research Program (NCHRP) Report 684 *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*, produced by Transportation Research Board, was used to calculate the internal capture for the development. This report provides extensive research into the internal capture rates for mixed-use developments. Internal capture calculations are included in the **Appendix**.

Pass-by trips are trips already on the roadway network that turn into the site as they pass by on the adjacent street. Pass-by percentages were calculated for the shopping center, restaurant and bank uses based on the data presented in the ITE *Trip Generation Handbook*, limited to a maximum of ten percent of the adjacent street traffic based on NCDOT and Village of Marvin guidelines. Note that no pass-by reductions during the AM peak hour were applied to the shopping center or restaurant uses since ITE does not provide pass-by percentages for ITE land-use codes 820 and 932 during the AM peak hour. Therefore, the resulting net, new external trips shown in **Table 5.1** likely represents a conservative number of trips expected to be generated by this site during the AM peak hour. Pass-by calculations are included in the **Appendix**.

Based on the current site plan, the proposed development is envisioned to include +/- 50,000 square feet (SF) of shopping center space. Per the TIA scoping process, the following land uses and intensities were used for the purposes of this TIA:

- 41,600 square feet (SF) of Shopping Center
- 4,500 SF High-Turnover Sit-Down Restaurant
- 3,500 SF Drive-In Bank

Table 5.1 summarizes the projected trip generation for the proposed development. During a typical weekday, the proposed development has the potential to generate 370 and 292 net, new external trips during the AM and PM peak hours, respectively.

Table 5.1 - Trip Generation

Land Use	Intensity	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Shopping Center (Building 1) [ITE 820]	22,400 SF	2,174	163	101	62	180	86	94
Shopping Center (Building 2) [ITE 820]	19,200 SF	1,957	161	100	61	160	77	83
High-Turnover Sit Down Restaurant [ITE 932]	4,500 SF	505	63	36	27	78	41	37
Drive-In Bank [ITE 912]	3,500 SF	350	33	19	14	72	36	36
Subtotal		4,986	420	256	164	490	240	250
Internal Capture		340	44	22	22	54	27	27
ITE 820 Pass-By - 0% AM / 34% PM		*54*	*0*	*0*	*0*	*54*	*27*	*27*
ITE 820 Pass-By - 0% AM / 34% PM		*48*	*0*	*0*	*0*	*48*	*24*	*24*
ITE 932 Pass-By - 0% AM / 43% PM		*18*	*0*	*0*	*0*	*18*	*9*	*9*
ITE 912 Pass-By - 29% AM / 35% PM		*30*	*6*	*3*	*3*	*24*	*12*	*12*
ITE Pass-By		*150*	*6*	*3*	*3*	*144*	*72*	*72*
Pass-By		150	6	3	3	144	72	72
Net, New External Trips		4,496	370	231	139	292	141	151

5.3 SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT

The proposed development's trips were assigned to the surrounding network based on existing peak-hour turning movements, surrounding land uses, locations of similar land use and population densities in the area. The following site traffic distribution was reviewed and approved as part of the TIA Scoping by the Village of Marvin and NCDOT:

- 30% to/from the north along Providence Road (NC 16)
- 15% to/from the west along New Town Road
- 10% to/from the east along New Town Road
- 10% to/from the north along Waxhaw-Marvin Road
- 10% to/from the south along Waxhaw-Marvin Road
- 15% to/from the south along Providence Road (NC 16)
- 5% to/from the west along Kensington Drive
- 5% to/from the east along Cuthbertson Road

As discussed in **Section 4.3**, once constructed, travel patterns will be affected within the immediate vicinity of NCDOT TIP Project U-5769. Therefore, the assignment of site traffic was developed for 2024 with U-5769 constructed. However, the overall site traffic distribution remains the same. The overall site traffic distribution and assignment for 2024 are shown in **Figure 5.1**.

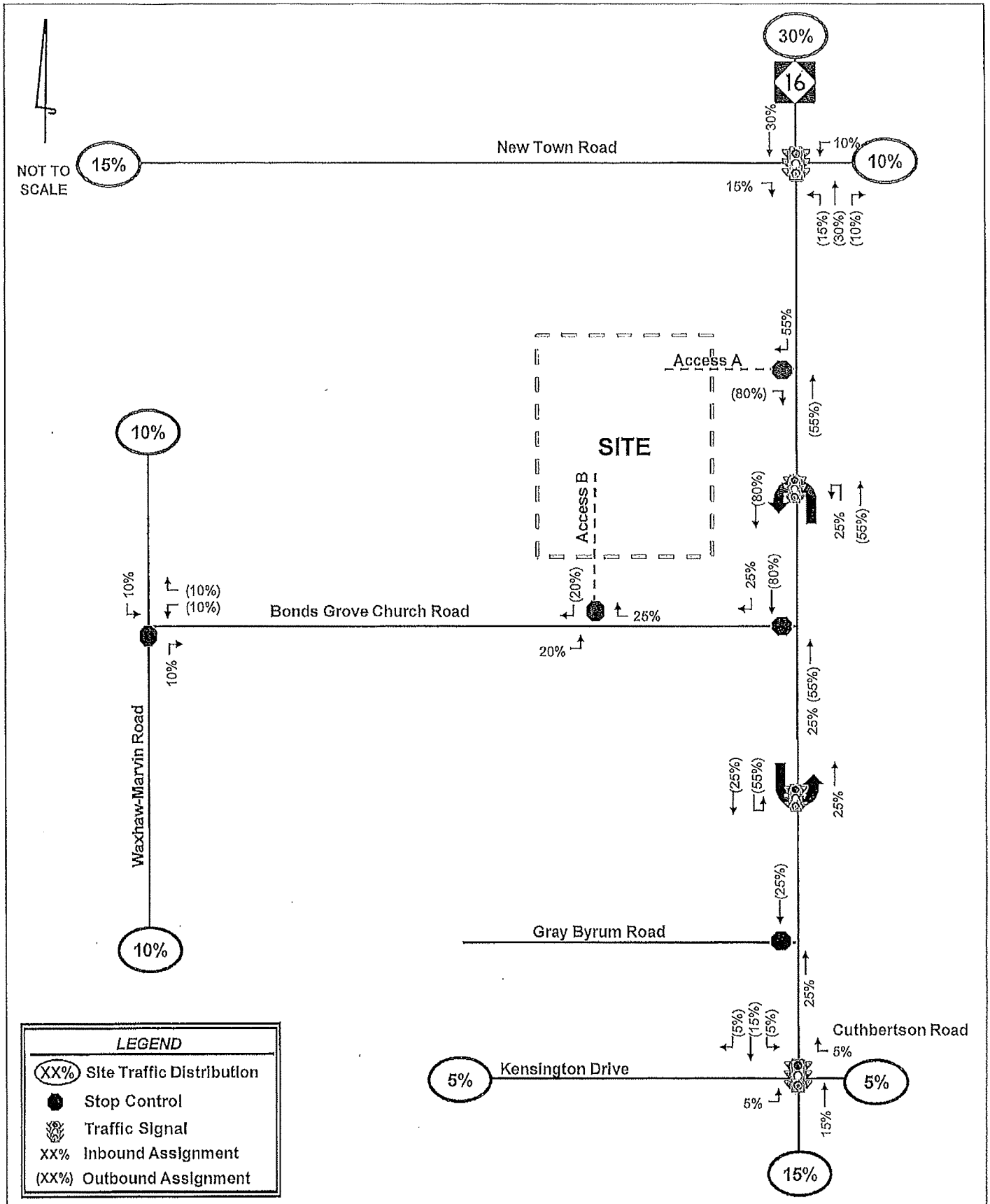
5.4 2024 BUILD-OUT TRAFFIC VOLUMES

The 2024 build-out traffic volumes include the assignment of the projected site traffic generation added to the 2024 background traffic volumes that account for the construction of NCDOT TIP Project U-5769. **Figures 5.2** and **5.3** show the projected 2024 build-out traffic volumes for the AM and PM peak hours, respectively.

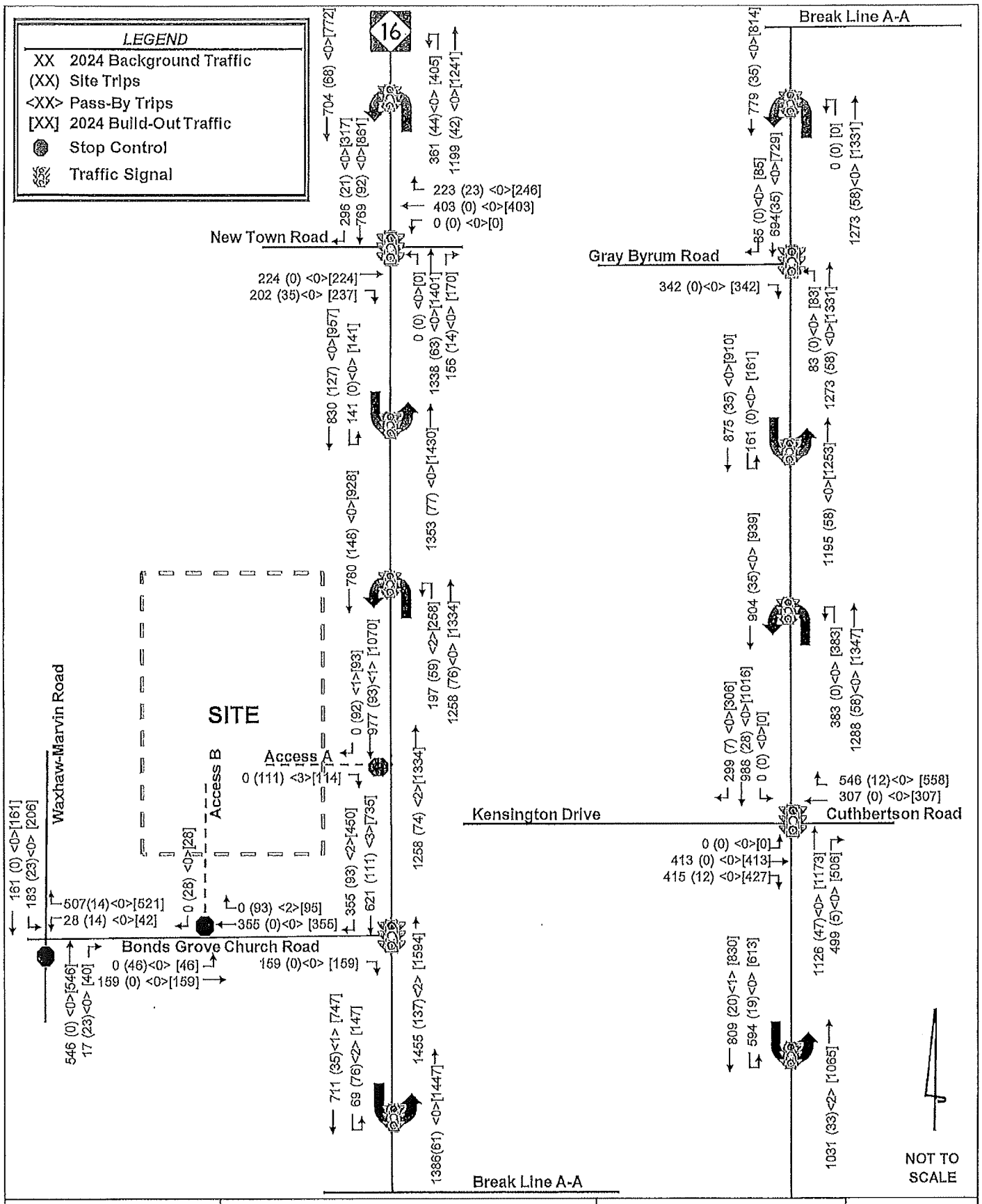
5.5 2040 BUILD-OUT TRAFFIC VOLUMES

As instructed by NCDOT, a 2040 design year analysis was performed. The 2040 build-out traffic volumes include the assignment of the proposed site traffic generation added to the 2040 background traffic volumes that account for the construction of NCDOT TIP Project U-5769. **Figures 5.4** and **5.5** show the projected 2040 build-out traffic volumes for the AM and PM peak hours, respectively.

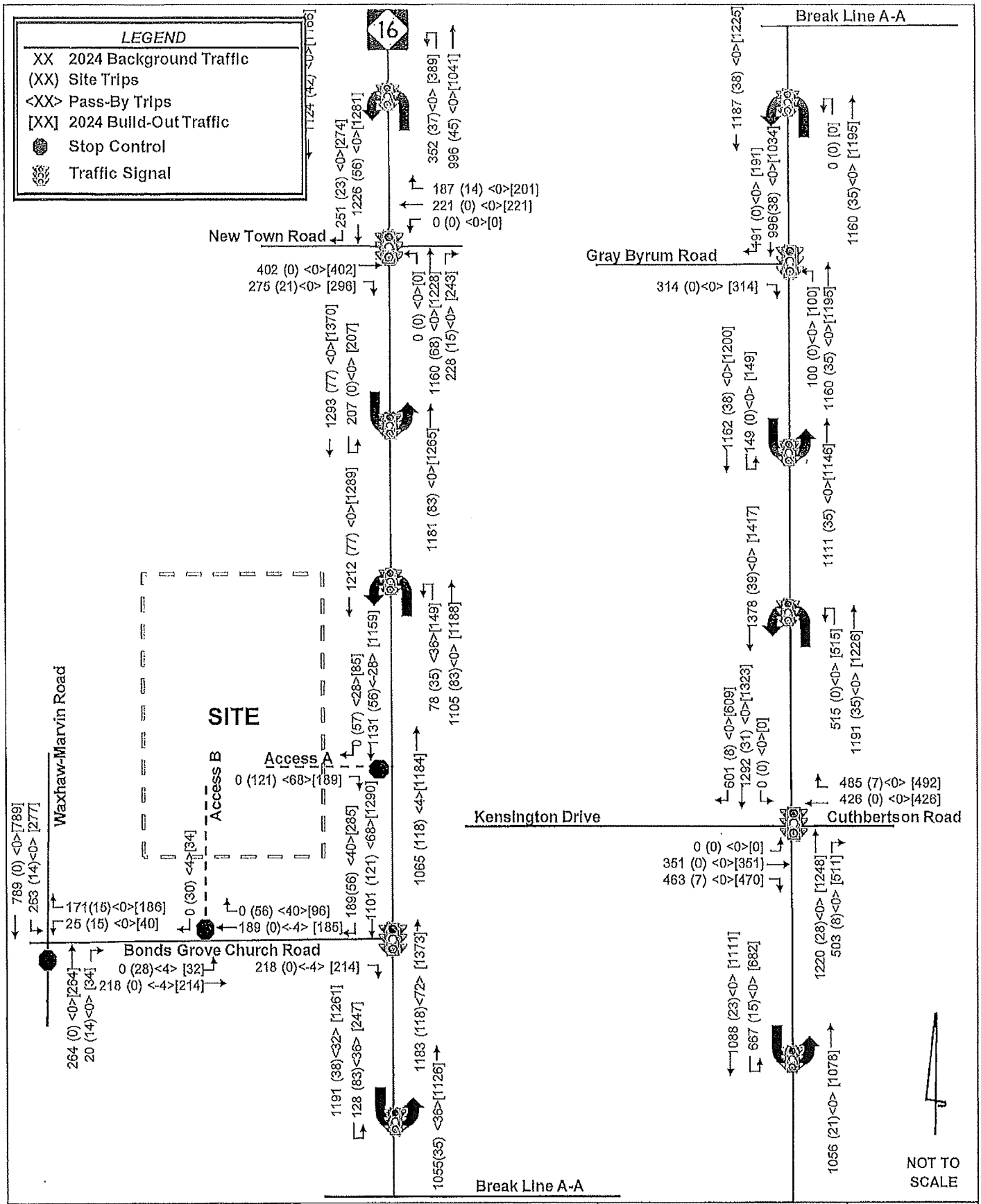
Intersection volume development worksheets for all intersections and driveways within the study network are provided in the **Appendix**.



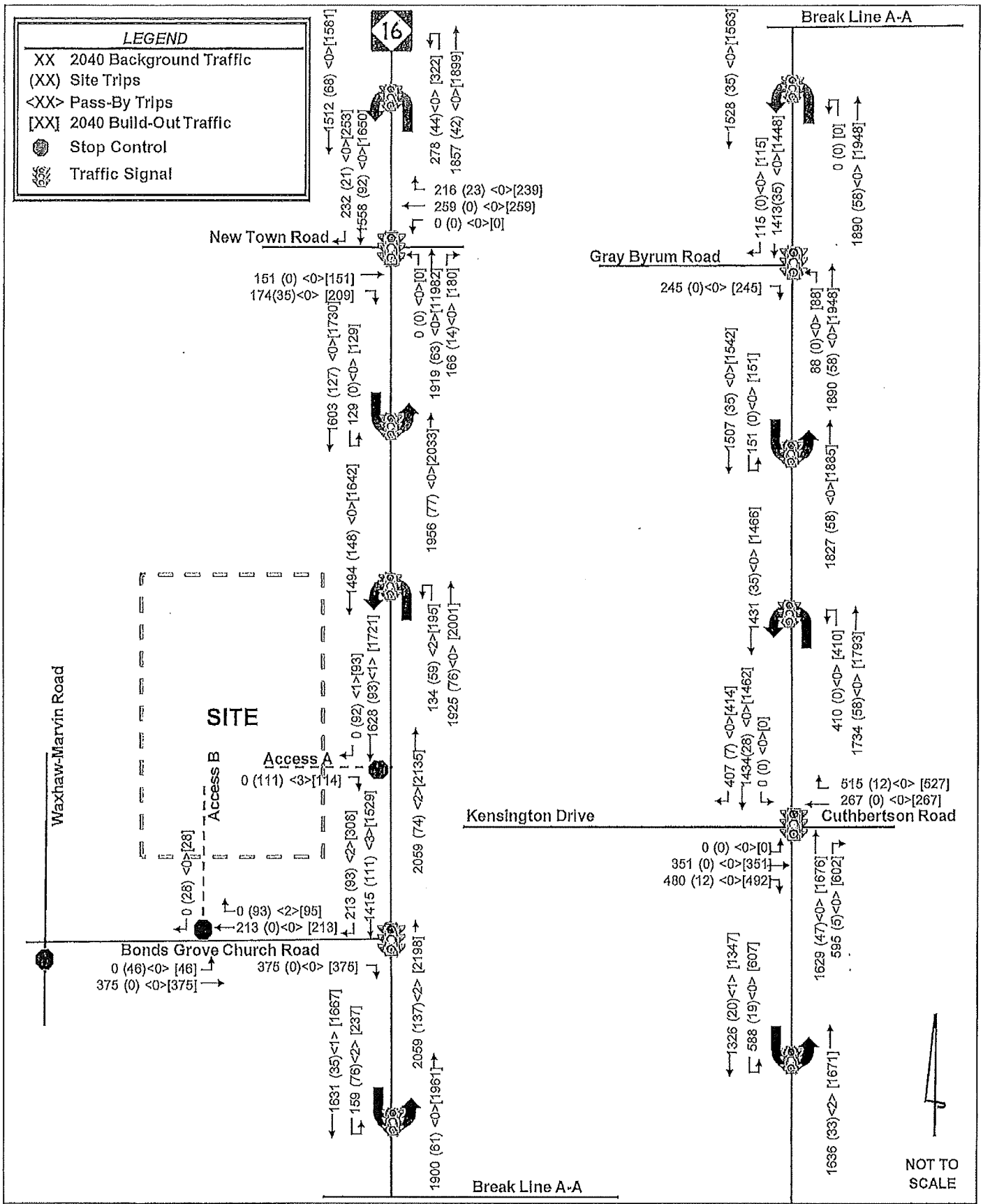
Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Site Traffic Distribution and Assignment	Figure 5.1



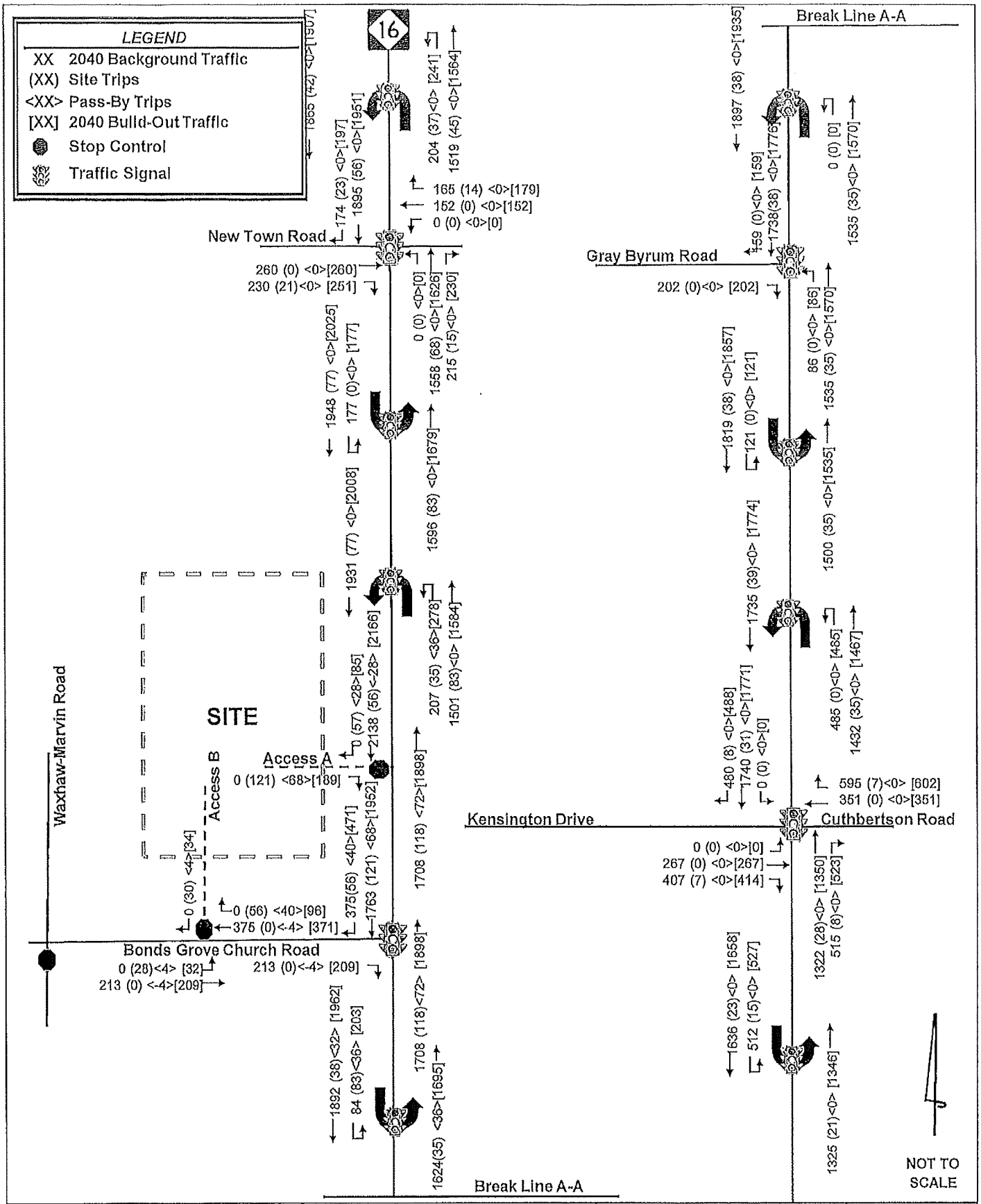
Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2024 Build-Out AM Peak-Hour Traffic Volumes	Figure 5.2



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2024 Build-Out PM Peak-Hour Traffic Volumes	Figure 5.3



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2040 Build-Out AM Peak-Hour Traffic Volumes	Figure 5.4



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	2040 Build-Out PM Peak-Hour Traffic Volumes	Figure 5.5

6.0 Capacity Analysis

Based upon the agreements made during the TIA Scoping Meeting and in accordance with the traffic study guidelines in the *NCDOT Policy on Street and Driveway Access to North Carolina Highways*, capacity analyses were performed at the study area intersections for each of the following AM and PM peak-hour scenarios:

- 2019 Existing Conditions
- 2024 Background Conditions
- 2024 Build-out Conditions
- 2040 Background Conditions (U-5769 design year analysis)
- 2040 Build-out Conditions (U-5769 design year analysis)

Capacity analyses were performed for the AM and PM peak hours using the Synchro Version 9 software to determine the operating characteristics at the signalized and stop-controlled intersections of the adjacent street network and to evaluate the impacts of the proposed development. Capacity is defined as the maximum number of vehicles that can pass over a particular road segment, or through a particular intersection, within a specified period of time under prevailing operational, geometric and controlling conditions within a set time duration.

The *Highway Capacity Manual* (HCM) defines level-of-service (LOS) as a "quantitative stratification of a performance measure or measures representing quality of service" and is used to "translate complex numerical performance results into a simple A-F system representative of travelers' perceptions of the quality of service provided by a facility or service". The HCM defines six levels of service, LOS A through LOS F, with A having the best operating conditions from the traveler's perspective and F having the worst. However, it must be understood that "the LOS letter result hides much of the complexity of facility performance", and that "the appropriate LOS for a given system element in the community is a decision for local policy makers". According to the HCM, "for cost, environmental impact, and other reasons, roadways are typically designed not to provide LOS A conditions during peak periods but instead to provide some lower LOS that balances individual travelers' desires against society's desires and financial resources. Nevertheless, during low-volume periods of the day, a system element may operate at LOS A."

LOS for a two-way stop-controlled (TWSC) intersection is determined by the control delay and is reported for the side-street approaches, typically during the highest volume periods of the day, the AM and PM peak periods. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. With respect to field measurements, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time the vehicle departs from the stop line. It is typical for stop sign-controlled side streets and driveways intersecting major streets to experience long delays during peak hours, particularly for left-turn movements. The majority of the traffic moving through the intersection on the major street experiences little or no delay.

LOS for signalized intersections is reported for the intersection as a whole, and typically during the highest volume periods of the day, the AM and PM peak periods. One or more movements at an intersection may experience a low level-of-service, while the intersection as a whole may operate acceptably.

Tables 6.0-A and 6.0-B list the LOS control delay thresholds published in the HCM for unsignalized and signalized intersections, respectively, as well as the unsignalized operational descriptions assumed herein.

Table 6.0-A Vehicular LOS Control Delay Thresholds for Unsignalized Intersections		
Level-of-Service	Average Control Delay per Vehicle [sec/veh]	
A	≤ 10	Short Delays
B	> 10 – 15	
C	> 15 – 25	
D	> 25 – 35	Moderate Delays
E	> 35 – 50	
F	> 50	Long Delays

Table 6.0-B Vehicular LOS Control Delay Thresholds for Signalized Intersections	
Level-of-Service	Average Control Delay per Vehicle [sec/veh]
A	≤ 10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

NCDOT staff provided the signal geometric plans for the following signalized intersections:

- Providence Road (NC 16) and New Town Road
- Providence Road (NC 16) and Kensington Drive/Cuthbertson Road

The provided signal plans were used in the development of the existing and background conditions Synchro network. The cycle lengths and splits were optimized at the New Town Road and Kensington Drive/Cuthbertson Road intersections in the existing conditions network given the timing inputs and in accordance with NCDOT Congestion Management guidelines. Given the significant signal and geometric modifications between 2019 and 2024 conditions related to NCDOT TIP Project U-5769, including the introduction of new limited-access signals at the U-turn bulbs, cycle lengths, splits and offsets were optimized again in 2024 background conditions and maintained through 2024 build-out conditions. For the TIP design year analysis, the cycle lengths, splits and offsets were optimized again in 2040 background conditions and maintained through 2040 build-out conditions. Signal geometric plans are included in the **Appendix**.

The following modifications from the background data collected were applied to the capacity analyses to meet NCDOT *Congestion Management Capacity Analysis Guidelines:*

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used in future years where protected/permitted left-turn phasing exists.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.
- Zero-volume movements were changed to four vehicles per hour in the analysis.

Per NCDOT capacity analysis guidelines, existing peak-hour factors were used in the 2019 existing conditions analysis, and a peak-hour factor of 0.9 was used for all future-year scenarios. Heavy-vehicle percentages collected with the counts were used for the existing conditions scenario, subject to a two-percent minimum, and the forecast heavy-vehicle percentages were used for all future-year scenarios.

Mitigation for traffic impacts caused by the proposed development were noted and identified based on NCDOT mitigation requirements. When determining the proposed development's traffic impact to the study area intersections, the 2024 build-out conditions were compared to the 2024 background conditions and the 2040 build-out conditions were compared to the 2040 background conditions. Based on the NCDOT's *Policy on Street and Driveway Access to North Carolina Highways*, "the applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exists when comparing base network conditions to project conditions:

a) the total average delay at an intersection or individual approach increases by 25% or greater, while maintaining the same LOS,
b) the LOS degrades by at least one level,
c) or the LOS is "F"."

Capacity analysis reports generated by Synchro Version 9 software are included in the **Appendix**. Additionally, queuing and blocking reports generated by the SimTraffic microsimulation model are included in the **Appendix**.

6.1 PROVIDENCE RD (NC 16) AND NEW TOWN RD

Table 6.1 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Providence Road (NC 16) and New Town Road. The 2024 and 2040 results reflect the intersection improved as part of NCDOT TIP Project U-5769.

Table 6.1 - Providence Road (NC 16) and New Town Road

Condition	Measure	EB			WB			NB			SB			Intersection
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	LOS (Delay)
AM Peak Hour														
2019 Existing	LOS (Delay)		D (42.9)			D (50.0)			C (32.1)			C (24.6)		D (35.5)
	Synchro 95th Q	66'	204'	-	94'	#429'	68'	85'	#828'	21'	33'	356'	-	
2024 Background	LOS (Delay)		B (19.8)			C (27.9)			B (18.8)			A (7.6)		B (17.2)
	Synchro 95th Q	126'	119'	-	-	#274'	132'	-	323'	m86	-	90'	80'	
2024 Build-out	LOS (Delay)		C (20.8)			C (28.1)			C (20.2)			A (8.0)		B (17.9)
	Synchro 95th Q	-	126'	141'	-	#274'	146'	-	#335'	m88'	-	113'	93'	
2040 Background	LOS (Delay)		D (38.6)			D (49.5)			A (19.5)			A (6.9)		B (19.1)
	Synchro 95th Q	-	144'	170'	-	#267	#233	-	731'	m39'	-	100'	m34'	
2040 Build-out	LOS (Delay)		D (42.1)			D (52.2)			B (19.9)			A (7.1)		B (19.8)
	Synchro 95th Q	-	144'	#220'	-	#267'	#270'	-	763'	m41'	-	114'	m35'	
PM Peak Hour														
2019 Existing	LOS (Delay)		E (75.3)			D (37.5)			C (29.1)			D (53.4)		D (47.8)
	Synchro 95th Q	90'	#498'	-	90'	170'	40'	74'	520'	34'	53'	#880'	-	
2024 Background	LOS (Delay)		C (28.5)			B (19.5)			B (18.2)			A (10.0)		B (17.0)
	Synchro 95th Q	-	#272'	166'	-	125'	111'	-	311'	141'	-	181'	m77'	
2024 Build-out	LOS (Delay)		C (29.2)			B (19.8)			B (19.7)			B (10.9)		B (18.0)
	Synchro 95th Q	-	#272'	#181'	-	125'	118'	-	336'	m144'	-	192'	m77'	
2040 Background	LOS (Delay)		D (47.9)			D (36.7)			B (16.8)			B (15.1)		C (20.7)
	Synchro 95th Q	-	#244'	#244'	-	143'	160'	-	576'	m120'	-	#777'	m23'	
2040 Build-out	LOS (Delay)		D (49.5)			D (37.1)			B (17.8)			B (17.8)		C (22.5)
	Synchro 95th Q	-	#244'	#277'	-	143'	172'	-	612'	m116'	-	#817'	m29'	

'#95th percentile volume exceeds capacity, queue may be longer
'm Volume for 95th percentile queue is metered by upstream signal

Note that the results shown in **Table 6.1** reflect the following modifications applied to the Capacity analyses that differ from the background data collected to meet NCDOT *Congestion Management Capacity Analysis Guidelines:*

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used in future years where protected/permitted left-turn phasing exists.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Table 6.1 shows the overall intersection currently operates at LOS D during both peak hours, with the side streets operating at LOS D.

2024 Conditions

Based on the current concept of NCDOT TIP Project U-5769 (included in the **Appendix**), significant modifications will be made to this intersection in future years. The following approach laneages are currently planned:

- Two through lanes and one right-turn lane northbound along Providence Road (NC 16)
- Two through lanes and one right-turn lane southbound along Providence Road (NC 16)
- One through lane and one right-turn lane eastbound along New Town Road
- One through lane and one right-turn lane westbound along New Town Road

With these improvements in place and redirecting all left-turn movements, **Table 6.1** shows that the overall intersection is expected to operate at LOS B during both peak hours under 2024 background conditions. When the proposed site traffic is added to the 2024 background volumes, the overall intersection is expected to remain at LOS B during both peak hours. Since the proposed

development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2024 build-out conditions.

2040 Conditions

As discussed in **Section 5.5**, a design year analysis was prepared for year 2040 with NCDOT TIP Project U-5769 in place. **Table 6.1** shows that the overall intersection is expected to operate at LOS B during the AM peak hour and LOS C during the PM peak hour under 2040 background conditions. When the proposed site traffic is added to the 2040 background volumes, the overall intersection is expected to remain at LOS B during the AM peak hour and LOS C during the PM peak hour. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2040 build-out conditions.

6.2 PROVIDENCE RD (NC 16) AND BONDS GROVE CHURCH RD

Table 6.2 summarizes the LOS, control delay and 95th percentile queue lengths at the future signalized intersection of Providence Road (NC 16) and Bonds Grove Church Road. The 2024 and 2040 results reflect the intersection improved as part of NCDOT TIP Project U-5769.

Table 6.2 - Providence Road (NC 16) and Bonds Grove Church Road						
Condition	Measure	EB	NB	SB		Intersection
		EBR	NBLT	SBT	SBR	LOS (Delay)
AM Peak Hour						
2019 Existing	LOS (Delay)	E (39.8)	A (4.4)	0		-
	Synchro 95th Q	66'	16'	0'	0'	
2024 Background	LOS (Delay)	C (22.6)	-	A (4.0)		A (6.6)
	Synchro 95th Q	55'	-	36'	44'	
2024 Build-out	LOS (Delay)	C (22.6)	-	A (4.7)		A (6.8)
	Synchro 95th Q	55'	-	51'	75'	
2040 Background	LOS (Delay)	D (39.5)	-	A (5.3)		B (11.7)
	Synchro 95th Q	177'	-	52'	m20'	
2040 Build-out	LOS (Delay)	D (39.6)	-	A (5.7)		B (11.4)
	Synchro 95th Q	177'	-	98'	m40'	
PM Peak Hour						
2019 Existing	LOS (Delay)	F (199.7)	A (2.2)	0		-
	Synchro 95th Q	244'	7'	0'	0'	
2024 Background	LOS (Delay)	C (22.4)	-	A (3.9)		A (6.6)
	Synchro 95th Q	69'	-	35'	9'	
2024 Build-out	LOS (Delay)	C (22.5)	-	A (5.2)		A (7.2)
	Synchro 95th Q	69'	-	58'	m29'	
2040 Background	LOS (Delay)	D (41.9)	-	A (3.0)		A (6.5)
	Synchro 95th Q	113'	-	90'	m31'	
2040 Build-out	LOS (Delay)	D (41.6)	-	A (5.4)		A (8.3)
	Synchro 95th Q	110'	-	m114'	m44'	

95th percentile volume exceeds capacity, queue may be longer

m Volume for 95th percentile queue is metered by upstream signal

Note that the results shown in **Table 6.2** reflect the following modifications applied to the Capacity analyses that differ from the background data collected to meet NCDOT *Congestion Management Capacity Analysis Guidelines:*

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used in future years where protected/permitted left-turn phasing is planned.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

2024 Conditions

Based on the current concept of NCDOT TIP Project U-5769 (included in the **Appendix**), significant modifications will be made to this intersection in future years. The following improvements and approach laneages are currently planned:

- Installation of a traffic signal
- Two through lanes northbound along Providence Road (NC 16)
- Two through lanes and one right-turn lane southbound along Providence Road (NC 16)
- Two right-turn lanes eastbound along Bonds Grove Church Road

With these improvements in place and redirecting all left-turn movements, **Table 6.2** shows that the overall intersection is expected to operate at LOS A during both peak hours under 2024 background conditions. When the proposed site traffic is added to the 2024 background volumes, the overall intersection is expected to remain at LOS A during both peak hours. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2024 build-out conditions.

2040 Conditions

As discussed in **Section 5.5**, a design year analysis was prepared for year 2040 with NCDOT TIP Project U-5769 in place. **Table 6.2** shows that the overall intersection is expected to operate at LOS B during the AM peak hour and LOS A during the PM peak hour under 2040 background conditions. When the proposed site traffic is added to the 2040 background volumes, the overall intersection is expected to remain at LOS B during the AM peak hour and LOS A during the PM peak hour. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2040 build-out conditions.

6.3 PROVIDENCE RD (NC 16) AND GRAY BYRUM RD

Table 6.3 summarizes the LOS, control delay and 95th percentile queue lengths at the future signalized intersection of Providence Road (NC 16) and Gray Byrum Road. The 2024 and 2040 results reflect the intersection improved as part of NCDOT TIP Project U-5769.

Table 6.3 - Providence Road (NC 16) and Gray Byrum Road								
Condition	Measure	EB		NB		SB		Intersection
		EBL	EBR	NBL	NBLT	SBT	SBR	LOS (Delay)
AM Peak Hour								
2019 Existing	LOS (Delay)	F (83.2)		A (2.0)		0		-
	Synchro 95th Q	167'	32'	-	6'	0'	0'	
2024 Background	LOS (Delay)	C (22.9)		C (20.4)		B (10.1)		B (14.5)
	Synchro 95th Q	-	170'	m56'	-	133'	22'	
2024 Build-out	LOS (Delay)	C (22.9)		B (19.9)		A (6.8)		B (12.1)
	Synchro 95th Q	-	170'	m53'	-	17'	6'	
2040 Background	LOS (Delay)	D (42.3)		C (23.1)		A (7.0)		B (12.4)
	Synchro 95th Q	-	219'	m47'	-	11'	3'	
2040 Build-out	LOS (Delay)	D (42.3)		C (23.4)		A (6.3)		B (11.8)
	Synchro 95th Q	-	219'	m46'	-	30'	7'	
PM Peak Hour								
2019 Existing	LOS (Delay)	F (75.6)		A (2.4)		0		-
	Synchro 95th Q	134'	49'	-	8'	0'	0'	
2024 Background	LOS (Delay)	C (22.2)		B (15.1)		A (7.5)		B (10.9)
	Synchro 95th Q	-	154'	m53'	-	87'	31'	
2024 Build-out	LOS (Delay)	C (22.2)		B (16.4)		A (8.0)		B (11.2)
	Synchro 95th Q	-	154'	m52'	-	#84'	37'	
2040 Background	LOS (Delay)	D (47.5)		C (27.3)		A (6.3)		B (10.9)
	Synchro 95th Q	-	#200'	m64'	-	7'	m2'	
2040 Build-out	LOS (Delay)	D (47.5)		C (27.1)		A (6.3)		B (10.8)
	Synchro 95th Q	-	#200'	m61'	-	11'	m3'	

95th percentile volume exceeds capacity, queue may be longer
m Volume for 95th percentile queue is metered by upstream signal

Note that the results shown in **Table 6.3** reflect the following modifications applied to the Capacity analyses that differ from the background data collected to meet NCDOT *Congestion Management Capacity Analysis Guidelines:*

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used in future years where protected/permitted left-turn phasing is planned.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.
- The zero-volume northbound U-Turn movement modeled in 2024 and 2040 conditions was adjusted to account for four vehicles per hour in the analysis.

2024 Conditions

Based on the current concept of NCDOT TIP Project U-5769 (included in the **Appendix**), significant modifications will be made to this intersection in future years. The following improvements and approach laneages are currently planned:

- Installation of a traffic signal
- Two through lanes and one left-turn lane northbound along Providence Road (NC 16)
- Two through lanes and one right-turn lane southbound along Providence Road (NC 16)
- One right-turn lane eastbound along Gray Byrum Road

With these improvements in place and redirecting the side-street left-turn movement, **Table 6.3** shows that the overall intersection is expected to operate at LOS B during both peak hours under 2024 background conditions. When the proposed site traffic is added to the 2024 background volumes, the overall intersection is expected to remain at LOS B during both peak hours. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2024 build-out conditions.

2040 Conditions

As discussed in **Section 5.5**, a design year analysis was prepared for year 2040 with NCDOT TIP Project U-5769 in place. **Table 6.3** shows that the overall intersection is expected to operate at LOS B during both peak hours under 2040 background conditions. When the proposed site traffic is added to the 2040 background volumes, the overall intersection is expected to remain at LOS B during both peak hours. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2040 build-out conditions.

6.4 PROVIDENCE RD (NC 16) AND KENSINGTON DR/CUTHBERTSON RD

Table 6.4 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Providence Road (NC 16) and Kensington Drive/Cuthbertson Road. The 2024 and 2040 results reflect the intersection improved as part of NCDOT TIP Project U-5769.

Table 6.4 - Providence Road (NC 16) and Kensington Drive/Cuthbertson Road

Condition	Measure	EB			WB			NB			SB			Intersection
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	LOS (Delay)
AM Peak Hour														
2019 Existing	LOS (Delay)	E (62.9)			D (40.6)			C (32.2)			C (34.3)			D (41.1)
	Synchro 95th Q	194'	#397'	-	#273'	275'	107'	95'	256'	95'	215'	288'	61'	
2024 Background	LOS (Delay)	C (24.3)			C (22.3)			B (13.1)			B (11.1)			B (16.3)
	Synchro 95th Q	-	#276'	117'	-	172'	161'	-	233'	#226'	-	99'	70'	
2024 Build-out	LOS (Delay)	C (24.3)			C (22.6)			B (13.6)			B (10.8)			B (16.4)
	Synchro 95th Q	-	#276'	120'	-	172'	164'	-	244'	#235'	-	99'	70'	
2040 Background	LOS (Delay)	D (41.9)			D (40.2)			B (12.9)			B (10.8)			C (20.2)
	Synchro 95th Q	-	#350'	221'	-	234'	#257'	-	423'	m263'	-	304'	168'	
2040 Build-out	LOS (Delay)	D (42.2)			D (41.0)			B (14.4)			B (11.5)			C (21.1)
	Synchro 95th Q	-	#350'	227'	-	234'	#268'	-	463'	m275'	-	315'	179'	
PM Peak Hour														
2019 Existing	LOS (Delay)	E (65.3)			D (53.8)			D (38.6)			D (38.7)			D (47.2)
	Synchro 95th Q	#281	335'	-	#325	318'	58'	#196'	227'	80'	201'	#577'	109'	
2024 Background	LOS (Delay)	C (21.4)			C (25.9)			B (14.4)			B (15.1)			B 17.7)
	Synchro 95th Q	-	200'	131'	-	#292'	140'	-	255'	#234'	-	214'	m#354'	
2024 Build-out	LOS (Delay)	C (21.5)			C (26.0)			B (15.0)			B (15.9)			B (18.1)
	Synchro 95th Q	-	200'	134'	-	#292'	142'	-	262'	#244'	-	#227'	m#349'	
2040 Background	LOS (Delay)	C (32.8)			D (45.7)			B (12.9)			B (15.8)			C (21.9)
	Synchro 95th Q	-	229'	181'	-	#342'	#313'	-	214'	179'	-	#523'	m226'	
2040 Build-out	LOS (Delay)	C (32.8)			D (46.0)			B (12.9)			B (17.4)			C (22.5)
	Synchro 95th Q	-	229'	184'	-	#342'	#319'	-	220'	183'	-	#610'	m232'	

#95th percentile volume exceeds capacity, queue may be longer
m Volume for 95th percentile queue is metered by upstream signal

Note that the results shown in **Table 6.4** reflect the following modifications applied to the Capacity analyses that differ from the background data collected to meet NCDOT *Congestion Management Capacity Analysis Guidelines:*

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used in future years where protected/permitted left-turn phasing exists on the northbound/southbound approaches.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Table 6.4 shows the overall intersection currently operates at LOS D during both peak hours, with the side streets operating at LOS D and E.

2024 Conditions

Based on the current concept of NCDOT TIP Project U-5769 (included in the **Appendix**), significant modifications will be made to this intersection in future years. The following approach laneages are currently planned:

- Two through lanes and one right-turn lane northbound along Providence Road (NC 16)
- Two through lanes and one right-turn lane southbound along Providence Road (NC 16)
- One through lane and two right-turn lanes eastbound along Kensington Drive
- One through lane and two right-turn lanes westbound along Cuthbertson Road

With these improvements in place and redirecting the side-street left-turn movement, **Table 6.4** shows that the overall intersection is expected to operate at LOS B during both peak hours under 2024 background conditions. When the proposed site traffic is added to the 2024 background volumes, the overall intersection is expected to remain at LOS B during both peak hours. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2024 build-out conditions.

2040 Conditions

As discussed in **Section 5.5**, a design year analysis was prepared for year 2040 with NCDOT TIP Project U-5769 in place. **Table 6.4** shows that the overall intersection is expected to operate at LOS C during both peak hours under 2040 background conditions. When the proposed site traffic is added to the 2040 background volumes, the overall intersection is expected to remain at LOS C during both peak hours. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for 2040 build-out conditions.

6.5 WAXHAW-MARVIN RD AND BONDS GROVE CHURCH RD

Table 6.5 summarizes the LOS, control delay and 95th percentile queue lengths under 2024 background and build-out conditions at the currently unsignalized intersection of Waxhaw-Marvin Road and Bonds Grove Church Road.

Table 6.5 - Bonds Grove Church Road and Waxhaw-Marvin Road				
Condition	Measure	NB	SB	WB
AM Peak Hour				
2019 Existing	LOS (Delay)	F (141. 3)	A (0.0)	A (0.5)
	Synchro 95th Q	517'	0'	1'
2024 Background	LOS (Delay)	F (423.0)	A (0.0)	A (0.7)
	Synchro 95th Q	993'	0'	2'
2024 Build-out	LOS (Delay)	F (530.8)	A (0.0)	A (1.0)
	Synchro 95th Q	1134'	0'	3'
2024 Build-out IMP	LOS (Delay)	F (426.9)	A (0.0)	A (1.0)
	Synchro 95th Q	1034'	0'	3'
PM Peak Hour				
2019 Existing	LOS (Delay)	D (28.4)	A (0.0)	A (1.6)
	Synchro 95th Q	105'	0'	2'
2024 Background	LOS (Delay)	F (96.2)	A (0.0)	A (1.8)
	Synchro 95th Q	273'	0'	3'
2024 Build-out	LOS (Delay)	F (149.1)	A (0.0)	A (2.7)
	Synchro 95th Q	352'	0'	5'
2024 Build-out IMP	LOS (Delay)	D (26.7)	A (0.0)	A (2.7)
	Synchro 95th Q	121'	0'	5'

Table 6.5 shows that the minor-street approach currently operates at LOS F during the AM peak hour and LOS D during the PM peak hour.

2024 Conditions

Table 6.5 shows that the minor-street approach is expected to operate at LOS F during both peak hours under 2024 background conditions. Based upon these results, mitigation at this intersection is required even without the presence of project traffic.

When the proposed site traffic is added to the 2024 background volumes, the minor-street approach is expected to remain at LOS F during both peak hours. An additional analysis was prepared to evaluate this intersection with a traffic signal and an exclusive northbound right-turn lane. The results of this analysis indicate that the overall intersection is expected to operate at LOS C during both peak hours.

This was identified as a candidate intersection project in the *Union County 2019 Critical Intersection Analysis* due to the current traffic volume crash frequency, and community support and has been included in its Top 15 list recommended for design. Further, this intersection was analyzed in the

Waxhaw-Marvin Road Corridor Study in which future improvements were identified and a concept for this intersection was developed. In that corridor study, the following improvements were identified for this intersection:

- Add turn lanes on all approaches to create two lane approaches on each leg of the intersection
- Install a signal at the intersection
- Realign the intersection to improve intersection skew and sight visibility
- Install bicycle and pedestrian accommodations

However, since this project is not currently funded, intersection improvements were not included in the background conditions. The identified existing issues at this intersection should still be considered as mitigation improvements are finalized.

While this laneage should be considered for the ultimate design of this intersection, the impacts of the site can be mitigated via the following improvement:

- Construction of a southbound right-turn lane from Waxhaw-Marvin Road onto Waxhaw-Marvin Road with 100 feet of storage

Based on auxiliary turn lane warrants in the *NCDOT Policy On Street And Driveway Access to North Carolina Highways,* a storage length of 500 feet would be warranted at this location. However, the maximum SimTraffic queue observed in this lane in either peak was 43 feet, which would be accommodated within the 100 feet of storage. SimTraffic reports can be found in the **Appendix.**

Final mitigation at this intersection should be coordinated with NCDOT and the Village of Marvin relative to long-term plans at this intersection.

6.6 PROVIDENCE RD (NC 16) AND ACCESS A

Table 6.6 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed unsignalized intersection of Providence Road (NC 16) and Access A. This access is proposed as a right-in/right-out (RIRO) driveway connection to Providence Road (NC 16), approximately 450 feet north of Bonds Grove Church Road; north of the proposed location of the future northbound U-turn bulb associated with the current superstreet design planned as part of State Transportation Improvement Program (STIP) Project No. U-5769.

Table 6.6 - Providence Road (NC 16) and Access A			
Condition	Measure	EB	SB
		EBR	SBTR
AM Peak Hour			
2024 Build-out	LOS (Delay)	A (9.6)	0
	Synchro 95th Q	12'	0'
2040 Build-out	LOS (Delay)	B (10.9)	0
	Synchro 95th Q	15'	0'
PM Peak Hour			
2024 Build-out	LOS (Delay)	B (10.1)	0
	Synchro 95th Q	22'	0'
2040 Build-out	LOS (Delay)	C (18.8)	0
	Synchro 95th Q	57'	0'

2024 Conditions

Based on the latest concept provided by NCDOT for TIP Project U-5769, two southbound through lanes along Providence Road (NC 16) are planned at the location of proposed Access A. **Table 6.6** shows the proposed eastbound approach of Access A is expected to operate as a RIRO driveway with minimal delays and queues during both peak hours under 2024 build-out conditions. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection under 2024 conditions.

2040 Conditions

Table 6.6 shows the proposed eastbound approach of Access A is expected to continue to operate as a RIRO driveway with minimal delays and queues during both peak hours under 2040 build-out conditions. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection under 2040 conditions.

6.7 BONDS GROVE CHURCH RD AND ACCESS B

Table 6.7 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed unsignalized intersection of Bonds Grove Church Road and Access B. This access is proposed as a left-over driveway connection to Bonds Grove Church Road, approximately 400 feet west of Providence Road (NC 16).

Table 6.7 - Bonds Grove Church Road and Access B					
Condition	Measure	EB		WB	SB
		EBL	EBT	WBTR	SBR
AM Peak Hour					
2024 Build-out	LOS (Delay)	A (1.9)		A (0.0)	B (11.2)
	Synchro 95th Q	4'	0'	0'	4'
2040 Build-out	LOS (Delay)	A (0.9)		A (0.0)	B (10.8)
	Synchro 95th Q	4'	0'	0'	4'
PM Peak Hour					
2024 Build-out	LOS (Delay)	A (1.0)		A (0.0)	A (9.9)
	Synchro 95th Q	2'	0'	0'	4'
2040 Build-out	LOS (Delay)	A (1.2)		A (0.0)	B (12.5)
	Synchro 95th Q	3'	0'	0'	6'

2024 Conditions

Based on the latest concept provided by NCDOT for TIP Project U-5769, one eastbound through lane and one westbound through lane along Bonds Grove Church Road are planned at the location of proposed Access B. To accommodate the left-over movement into the site, one eastbound left-turn lane is recommended, as further discussed in **Section 7.0**. **Table 6.7** shows the proposed southbound approach of Access B is expected to operate as a left-over driveway with minimal delays and queues during both peak hours under 2024 build-out conditions. Therefore, no additional improvements beyond construction of the driveway and the eastbound left-turn lane are recommended at this intersection under 2024 conditions.

2040 Conditions

Table 6.7 shows the proposed southbound approach of Access B is expected to continue to operate as left-over driveway with minimal delays and queues during both peak hours under 2024 build-out conditions. Therefore, no additional improvements beyond construction of the driveway and the eastbound left-turn lane are recommended at this intersection under 2040 conditions.

7.0 Auxiliary Turn-Lane Warrants

Warrants for additional turn-lane improvements for unsignalized intersections beyond those necessary for capacity were determined based on a review of the figure titled 'Warrant for Left and Right-Turn Lanes' found on page 80 in the *NCDOT Policy On Street And Driveway Access to North Carolina Highways*. The results of the warrants for left and right-turn lanes under 2024 build-out conditions are summarized by intersection below and included in the **Appendix**.

Providence Road (NC 16) and Access A

- Southbound right-turn lane along Providence Road (NC 16) with a minimum storage length of 75 feet

Bonds Grove Church Road and Access B

- Eastbound left-turn lane along Bonds Grove Church Road with a minimum storage length of 50 feet
- Westbound right-turn lane along Bonds Grove Church Road with a minimum storage length of 75 feet

Per NCDOT guidelines, a minimum of 100 feet of storage will be required for the warranted turn lanes.

8.0 Mitigation Improvements

Based on the capacity analyses performed at each of the identified study intersections, along with review of the auxiliary turn-lane warrants contained herein, the following improvements are identified to mitigate the impact of the proposed development on the adjacent street network:

Waxhaw-Marvin Road and Bonds Grove Church Road

- Northbound right-turn lane along Waxhaw-Marvin Road with 100 feet of storage

Providence Road (NC 16) and Access A (RIRO)

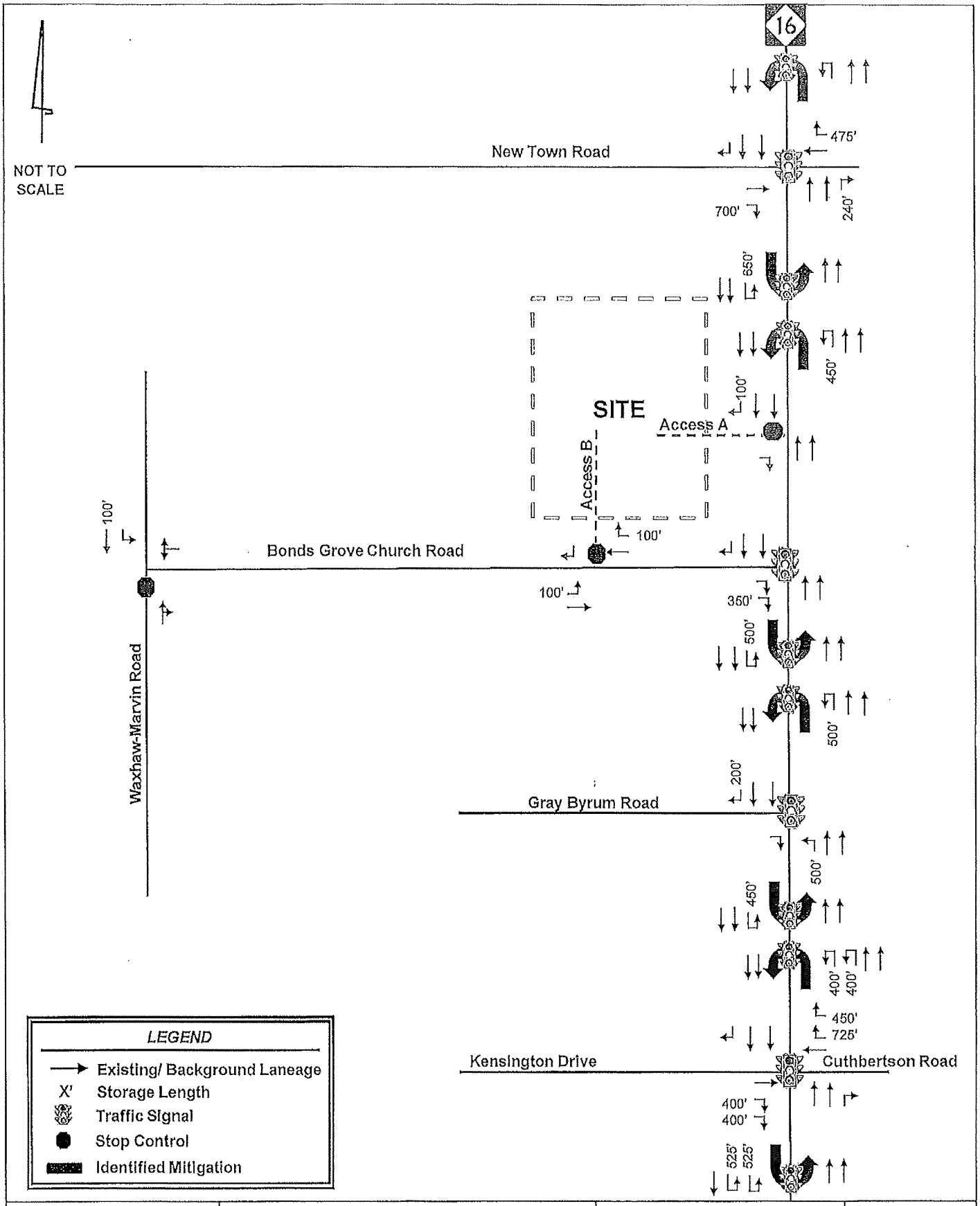
- Southbound right-turn lane along Providence Road (NC 16) with 100 feet of storage
- Single egress lane and single ingress lane along Access A

Bonds Grove Church Road and Access B (Left-Over)

- Eastbound left-turn lane along Bonds Grove Church Road with 100 feet of storage
- Westbound right-turn lane along Bonds Grove Church Road with 100 feet of storage
- Single egress lane and single ingress lane along Access B

No additional improvements were identified to mitigate the impact of the proposed development on the adjacent street network during 2040 conditions.

The mitigation improvements identified within the study area are shown for 2024 and 2040 conditions in **Figure 8.1**. The improvements shown on this figure are subject to approval by NCDOT and the Village of Marvin. All additions and attachments to the State and Town roadway system shall be properly permitted, designed and constructed in conformance to standards maintained by the agencies.



Kimley»Horn	Providence Road Commercial Traffic Impact Analysis	Identified Mitigation Improvements	Figure 8.1

APPENDIX